PUBLIC WORKS

An Engineering and Construction Journal

City County State

VOL. 63 AUGUST, 1932 NO. 8

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Brain Teasers

Conducted by

Benjamin Eisner

Two excellent solutions to the June number problem have been received. Space limitations prevent the publication of the algebraic equations formulated by Mr. Don T. Hastings, President of the Twin-Flex Corporation, Detroit. The other solution by Mr. H. E. Brown, County Highway Engineer, Columbia, Missouri, furnishes an interesting example of the possibilities of using the rule of nines in number problems. His solution is also too long for reproduction here, but will be sent on request to this department.

THAT FLAG POLE

The flag pole stub (last month's problem) is 48.64 feet high. Although there are two real roots to the cubic equation which must be used in the solution, one of which is the above, the remaining root 6.94 is eliminated because a cut at that height would not necessarily require the services of a steeple-jack. Mr. Walter S. Wheeler, City Engineer of Dover, New Hampshire, sent in the first solution received.

The problem this month concerns a

PERPLEXED PAINTER

who rigged up a plank for a scaffold. Evidently he had had little experience, for he supported the scaffold from a single roof hook and pulley. After attaching a rope to one end of the plank, he passed the rope over the pulley, and to the other end of the rope, fastened a second pulley. Then he attached a second rope to the other end of the plank, passed this rope over the second pulley and heaved on the free end. Somehow he managed to raise himself, standing on the plank, about half-way up to where he wanted to paint. The going became so difficult that he stopped to rest. After repeated unsuccessful attempts to tie the rope somewhere, he gave up, just keeping his position and pulling on the rope. The plank weighed ninety pounds and was of uniform section. The painter weighed 175 pounds. Neglecting all other weights, how much in pounds was the pull on the rope in the painter's hands?

This one appears in a standard text on "trick geometry."

By means of a compass alone, locate a point midway between two given points.

Regular geometry theorems may be used in the proof, although a logical proof is possible based on theorems obtained without the necessity of drawing lines, other than arcs of circles.

Next month, a prohibition problem.

BENJAMIN EISNER.

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PUBLIC WORKS

City, County and State Engineering and Construction

Vol. 63 August, 1932 No. 8

Tildenville-Oakland Road, Orange Co., Fla. Surface 18 feet wide. Treatment 0.2 gal. prime and one-third gal. seal, with 30 pounds No. 46 slag per sq. yd. Under traffic 18 months. Maintenance cost reported as $150 per mile average.

Low-Cost Bituminous Roads

Many requests have come to us from engineers, highway superintendents, and contractors asking for full and specific information on the design and construction of low-cost bituminous roads. This is the first of a series of articles which is intended to give such information.

SCOPE.—For the purpose of this series of articles, low-cost bituminous roads will be considered as including only those which involve the use of bituminous products—tars, asphalts and emulsions—and the construction of which costs not more than 70 cents per square yard under average conditions. These may be classified under the heads: Treatment of natural soils; surface treatments for gravel, macadam and other low-type roads; road-mix and retread surfaces; and plant mixes.

Requirements for Low-Cost Roads.—From the viewpoint of the road user, *all* surfaced and treated roads should:

Afford a smooth and safe riding surface.

Be serviceable the year around.

Be satisfactory in regard to grade, curvature and crown.

From the viewpoint of the highway engineer or superintendent, such roads must be relatively simple to build, and the construction process must employ equipment that is reasonably cheap and that can be used for other purposes, as for maintenance, when not employed on construction.

Yet, as is said in substance in a recent report of the American Road Builders' Association, low-cost does not mean careless design, poor materials, or poor workmanship. It often takes far more skill and judgment to build a low-cost road than to build a high-cost one. There is no place in low-cost road construction for slovenly work. Unless the job can be done properly, it is better not to do it at all. A half-way built low-cost road is money thrown away. What can be afforded should be done right. If any doubt exists as to what practice to follow, such as how much or what kind of bitumen to use, advice should be secured from someone who knows. Guessing gives

poor results. Experience or competent advice gives good results, but the latter is the cheaper in the end.

Financial Aspects.—The expenditure of money for road construction should be limited to the amount that the road may reasonably be expected to earn in the form of service rendered, considering the traffic it will carry and the population it will serve. This generally means that on through highways carrying less than 1,500 vehicles per day, and on all secondary roads, low-costs types will be used.

Essentials in Low-Cost Construction.—There are two prime essentials in satisfactory and serviceable low-cost road construction—indeed, in every type of road construction. These are *drainage* and *uniformity.*

No matter what type of surface is to be laid, no matter what the cost, the roadbed should be carefully drained so that free water will not stand on the road surface or in the ditches. The water table should be kept well below the surface by means of adequate ditches, and by frequent culverts; or, in very flat sections, by constructing the road in fill from material taken from the ditches. There is no set rule that can be applied in all cases, for much depends upon the climatic conditions, soil conditions, etc., but the top of the water table should be at least 6 inches below the bottom of the road surfacing; 12 inches is better.

Every foot of the pavement should have the same quality and the same characteristics as every other foot. Pot-holes and raveling occur because of lack of uniformity—non-uniform distribution of the binding substance, or coarse material in one place and fine material in another, with consequent varying penetration of the asphalt or tar, uneven wear and deterioration. Knowledge of local conditions, perhaps sampling and sieve analysis of the materials, and competent advice where necessary, will materially reduce or entirely eliminate these troubles.

It does no good, in the final analysis, to build even 90% of the road surface properly, if the other 10% is improperly done. To obtain satisfaction and adequate service from a road, *all* of it must be built properly in the first place.

From the point of view of cost, employment of local materials is also practically an essential in low-cost road construction. A knowledge of the materials at hand, and their adaptability in connection with the various bituminous materials, is necessary. With the efficient development of commercial plants producing aggregates, high-grade products are now available at low cost in many areas.

Mixed-in-Place or Road-Mix Types

Surfaces of this type are known by a variety of names, such as retread, mixed-in-place, oil-processed, etc. Because of their wide adaptability for use, ease of construction, and general satisfaction, they will be considered first. In this article, construction methods and equipment will be briefly outlined, and in the next article they will be discussed in detail in connection with design, construction details, materials, equipment and ability to carry traffic smoothly and rapidly.

"Road-mix" is the term employed to describe the mechanical mixing of the mineral aggregate and bitumen directly on the road bed or road base, as compared to mixing in plants and then applying to the road. Road-mix as used here applies to wearing courses not less than one-inch in thickness, and does not apply to surface treatments involving the dragging or brooming of aggregate cover on a bitumen-treated road. Road-mix surfaces are of two types, the *macadam aggregate,* and the *graded aggregate.*

In the former type, the aggregate is of crushed stone, crushed gravel or slag, generally ranging in size from ¾ to 1½ inches; in the latter type, the aggregate is an open graded product ranging in size from 1½ inches down to dust. Each of these types has a particular field of usefulness. In general, the macadam aggregate type is used when it is necessary to put a new wearing surface on a well-bonded base, and as such is frequently called "retread." The use of the graded aggregate type sometimes involves the reconditioning of an existing wearing surface, such as gravel, which has become dusty or worn, the addition of new material, or a combination of both.

Construction of Macadam Aggregate Type.—When placed on previously treated surfaces, no primer is required, but the aggregate is spread evenly on the road surface to a depth of about 2½ inches, and harrowed to insure a uniform texture and to eliminate dust pockets. Bitumen is then applied, and the entire material mixed by the use of graders, bladers, maintainers, drags or harrows. Several turnings of the stone is required, after which it should be spread out on the road surface and another application of bitumen given. Following this, it should be bladed or harrowed again until thoroughly mixed and then spread evenly and smoothly over the road surface. Rolling should start as soon as the mixture begins to set up; planing or dragging in the meantime will aid in securing a smooth riding surface.

From one to several weeks later, a seal coat is applied and the surface covered with fine aggregate, which should be dragged to insure thorough mixing and a smooth surface.

Construction of Graded Aggregate Type.—If the existing surface is sufficiently thick and stable, the necessary material may be obtained by scarifying. If not, new material must be added, preferably several weeks before the surface is to be constructed. Analyses should be made to determine the quality of the material, and the necessary corrections made. With the surface scarified to a depth of about 2½ inches, the first application of bitumen is made, and the surface immediately disked to obtain partial mixing. Additional applications are made and the surface treated until the re-

Mixed-in-place or road-mix types will be discussed next month by a leading engineer in the industry who will give definite information on design and construction methods for macadam aggregate type of construction, and by another prominent engineer who will give similar information concerning the graded aggregate type.

The River Road, Floyd County, Ind. It is of the macadam aggregate or "retread" type, road-mix construction.

quired amount of bitumen has been applied, after which the mix is bladed to a windrow and, by the use of tractor-grader or similar outfits, is bladed back and forth over the road until complete mixing has been accomplished, when it is bladed and dragged until a smooth and even surface is obtained. Rolling is not necessary, as the mix compacts well under traffic, and may be kept to proper grade and contour by occasional blading. A seal coat, covered with sand or screenings, is applied several weeks later.

Surface Treatment

For surface treatment, the road to be treated must have stability and structural strength to carry the loads it will be called upon to sustain. Surface treatments merely preserve the surface from wear and deterioration, and waterproofs it. In all surface treatments, the first step is adequate preparation of the roadbed by grading, dragging, draining and repairing weak places.

On roads having well-compacted and solid bases, the surface is first swept to remove all dust and is then primed to provide a bond with the surface coating. A day or two later the seal coat is applied and the surface covered with crushed chips, preferably by means of spreaders. The surface is then thoroughly rolled.

Where the road material is loose or poorly compacted, the solution is to add an artificial binder, after the surface has been prepared by blading and grading to the proper shape. Thereafter the method of treatment is the same as for roads having compacted bases, except that sweeping may not be necessary.

Plant-Mixes

There are many types of plant mixes, not all of which fall within the cost limits set forth in the first paragraph of this article. Since some of them do, however, this type will be discussed very briefly here, and more fully in a later article of this series.

The aggregates and the bitumen are proportioned, usually by weight, and mixed in either stationary or portable plants, from which the resulting mix is hauled to the road. In these plants it is probable that a higher degree of control of the mixture can be accomplished than in road mixes. Both pug mill and drum mixer types are used, standard concrete mixers being well adapted for such work, and recently a new type of mixer has been developed for the continuous coating of aggregate by immersion. Another recent development is a combined mixer, spreader, tamper and finisher, which picks up aggregate from the roadway and converts it into finished pavement in one operation.

In connection with some plant mixes, mechanical finishing equipment has been used to secure the necessary smoothness of riding surface.

Mixed-in-place or road-mix types will be discussed in our next issue by George E. Martin of the Barrett Co., who will give definite information on design and construction methods for the macadam aggregate type of construction, and by Bernard E. Gray of the Asphalt Institute, who will give similar information in regard to the graded aggregate type.

Recent Low-Cost Road Articles

Articles on the subject of low-cost roads which should be of value to our readers in securing the maximum benefit from this series include the following which have appeared in PUBLIC WORKS during the past year (since July, 1931);

Surface Treatment Methods and costs in a Number of Counties—July and August.

Low Costs and Smoothness Feature Maine Surface Treatment Methods—August.

Oil Treatment of Earth Roads—September.

Experimental Farm Roads in New York State—December.

Asphaltic Gravel for Low Cost Streets. By W. McK. White—January.

A New Method of Bituminous Road Surfacing—January.

Rejuvenating Old Pavements in Charlotte. By Wayt Thomas—January.

New Developments in the Use of Asphalt for Road Surfacing. By B. E. Gray—January.

Surface Treating Gravel Streets in Newport News. By A. R. Taylor—February.

Equipment for Constructing and Maintaining Low-Cost Road Surface—February and March.

Road construction in McDowell Co., West Virginia. By Charles H. Payne—April.

Surface Treatment Methods and Results in New Hampshire—April.

Dust Treatment with Oil and Calcium Chloride—July.

Bituminous Surfacing Mixing Methods on Nevada Roads—October, 1931.

Large Crusher Run Stone Used in Mixed-in-Place Tar Road. By H. L. Tilton—June, 1932.

Equipment and Bituminous Treatment Methods for Gravel & Macadam. By H. E. Sargent—July, 1932.

How Tennessee Surface Treats Gravel and Chert Roads. By Briggs Smith—July, 1932.

A Durable Asphalt Road for $4,500 per mile. By K. M. Banks—July, 1932.

A limited number of copies of these issues are available at the regular prices. Write to this magazine.

Unusual Features of Sewage Treatment at Bradford, England

Coal for filter medium. Heat for grease removal. Advantage of mixing grit and rags with sludge.

THE third edition of the report of Bradford, England, concerns the construction and operation of its sewage treatment plant.

The disposal works receives the sewage from a population of 287,400. The dry-weather flow averages 63 gallons per capita, (18,000,000 g. p. d.) which increases to 96,000,000 gallons per day in wet weather, the average being 23,750,000 g. p. d. The sewers receive large amounts of water discharged from wool-washing plants, which gives a high rate of flow during working hours and also troublesome quantities of wool fat. The crude sewage contains an average of 890 parts per million of grease, but much more than this when the wool scouring wastes are being discharged. The sewage also contains "very coarse grit, lumps of clotted cotton waste, wool and rags of large size," which are intercepted in a tank, from which they are dredged. The finer mineral matters are retained in the settling tanks, where also the floating matters are intercepted by deep scum boards.

Precipitating Wool Fat

Originally lime was used for precipitating the wool fat, but later this was abandoned in favor of ferric sulphate; but this proved to be too expensive and sulphuric acid was used instead, and is still in use, being manufactured at the sewage works. By the use of sulphuric acid, soaps are cracked and dissolved organic matter precipitated, wool waxes and suspended matters being carried down in the process.

Formerly the sewage was treated with acid for 24 hours a day, but the expense was great; moreover it was found that the filtration of such acid sewage presented difficulties. Experiments therefore were made in reducing the amount of acid. It was found that the best results of filtration were obtained when the pH value of the tanks effluent was about 6. The present practice is to add acid only when actual wool suds are arriving at the sewage works; no acid being added at night or from Saturday noon to Monday morning, or during very wet weather. Further economies will probably be obtained in the future by taking advantage of the chemical qualities of various sewages and wastes received.

The policy of separate treatment of woolcombers' suds at their own works, which was once adopted, proved to be impracticable, and the municipality had to prepare a scheme for works which would deal with all the trade refuse mixed with the sewage.

Sludge Treatment

Practically all of the sludge from both the detritus and precipitation tanks is pressed into cakes, 128 sludge presses being used for the purpose. It is found that the coarse grit, rags, paper and all fibrous matters removed in the detritus tank aid in this treatment of the sludge, and all of this is mixed with the sludge before pressing. Moreover, it has been found that an increase of the suspended solids in the sewage that has been treated with sulphuric acid tends to give a better effluent, for which purpose the sludge from the secondary tanks is pumped back to mix with the incoming sewage.

This intentional mixing of grit, paper, rags, etc,, with the sludge is similar to the process employed at Dearborn, Mich. (See PUBLIC WORKS for Nov., 1931.)

Prior to being pressed, the sludge is passed into large vats where it is heated by means of steam coils; heating being found necessary for expelling the grease. In the filter presses the liquid grease and water are expelled through cotton cloths and solid cakes formed inside the presses which, when the presses are opened, fall into wagons below, in which they are carried to a drying area.

Coal as Filter Medium

The tank effluent is treated on 53 acres of filters 6 feet deep, giving a cubic yard of filter for 35 gallons of settling tank effluent per day. Hard Yorkshire coal is used as a filter medium and has proved very satisfactory, and moreover can be used as fuel at any time, apparently not losing any calorific value during long years of service in the beds. During the general strike in England in 1926, the gas and electric services of Bradford were maintained at full output wholly by use of the coal from the filters, and in addition, factories in Yorkshire and Lancashire and householders in the city were supplied; 200,000 tons being sold and afterwards replaced. One cubic yard of this coal weighs 1100 pounds and is actually cheaper at Bradford than any other material.

Rat Destruction at Refuse Dumps

In a report dealing with the subject of rat destruction, Charles Frobisher, surveyor to the Swaffham Urban District Council, England, describes the methods by which a refuse dump in his area has been practically cleared of these rodents. The dump was ringed with traps at night, and such portions not so treated were fenced with close-mesh wire netting. Ammoniacal gas water was sprayed down the rat holes inclining downwards, while automobile exhaust gases were piped into rat holes, inclining upwards. Trade refuse from the fishmongers, butchers, etc., was treated with rat poison, and every day the refuse is now sprayed with gas liquor from the adjacent gasworks, which, while being most distasteful to the rodents, is a mild inoffensive disinfectant. In principle, local authorities, Mr. Frobisher suggests, should view houses and trade refuse dumps as rat destruction grounds, and arrange accordingly. Instead of driving the rats away, steps should be taken to entice them to the dumps. The dump should be permanently fenced with close-mesh wire fencing, which can be made unclimbable by curling the top of the fence over until it resembles a semi-circle in section. Definite and predetermined openings can be left open during the day, but such openings would be closed at night, when the traps are baited and set.

Powdered Activated Carbon Used Without Filtration

By Aaron B. Hess
Owner of the Belmont Water Co.

Source of water supply of Belmont Lake

BELMONT LAKE, PA., a suburb of Lancaster, supplied with water by the Belmont Water Co., is one of the first places where powdered activated carbon has been applied without employing filters to remove it, and a description of such use will undoubtedly be of interest to the readers of PUBLIC WORKS.

This plant draws its supply from a lake approximately four acres in area, having a maximum depth of 30 feet, and containing approximately 40,000,000 gallons of water. It is fed by springs supplying 225,000 gallons daily.

Due to a limestone stratum, the water has a pH of 8.4 and a hardness of 220. To correct this condition a water softener, manufactured by the American Water Softener Company, was installed, which reduced the pH to 7.0 and the hardness to zero. As this is too low for handling in the pipes, only half the water is passed through the softener and this is mixed with an equal quantity of unsoftened water (so-called split treatment).

The water from the pumping station goes to a standpipe 2800 feet away, 150 feet high and containing 350,000 gallons of water, from which it passes into the distribution system.

The quality of the water is unusually good, but in April of this year a heavy algae growth developed. This was corrected with the addition of copper sulfate, but the dead algae gave a very bad taste and produced heavy turbidity.

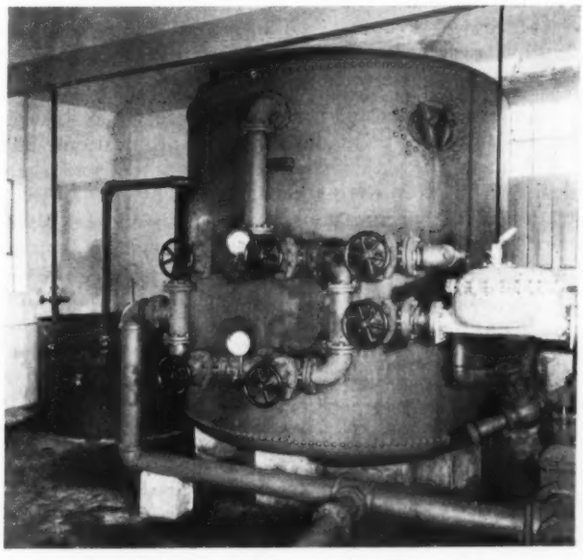
While it was known that powdered activated carbon would remove this taste, it was a problem how it could be employed for this plant does not have filters, and consequently it was feared that some of the carbon might get into the distribution system.

The first suggestion was to add carbon to the intake of the water softener; but as only half of the water is passed through this, it was obvious that the taste would be removed from part of the water only. It was then decided to add the carbon directly to the lake, storing several days' supply in the stand pipe so that it would be possible to shut down the pumping station to permit time for the carbon to settle out. The manner of distributing the activated carbon was to add five pounds to a barrel of water and to place this barrel in a rowboat and have a man scatter the slurry over the surface of the lake. While this is very crude, it worked.

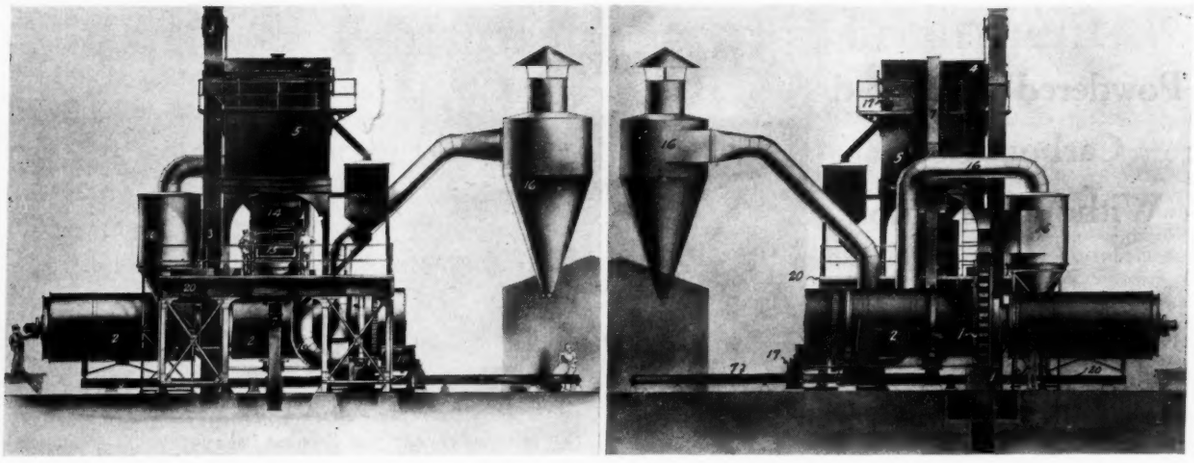
Five hundred pounds of Aqua Nuchar was received by motor express service from Tyrone, Pennsylvania, and at first only the section of the lake nearest the pumping station was treated; but the improvement in taste was so noticeable that it was decided to treat the entire lake and an additional quantity of Aqua Nuchar was ordered and applied to the rest of the lake. This powdered activated carbon settled out completely in twenty-four hours, and to date there has been no evidence that any of it has entered the distribution system. The turbidity and odor have disappeared and the water is exceedingly palatable and favorably commented on. Since this treatment, the softener does not need to be washed as frequently.

The 40,000,000 gallons of water in the lake was treated with 1,100 lbs. of Nuchar and 380 lbs. of copper sulphate. Precipitation carried down the fine particles of dead algae, Nuchar and considerable calcium carbonate, reducing the turbidity to an average of 5. The entire cost, including labor, was about $200.

Acknowledgement is made to John W. Hassler and Fred E. Stuart, of the Industrial Chemical Sales Company, Inc., Tyrone, Pa. and New York City, for their help.



Water softener of Belmont Lake Water Co.



Front and rear views of the hot-mix asphalt plant contracted for by Minneapolis
The numbers indicate the features of the plant which correspond to the numbered items in the city's specifications and the manufacturer's plans. For example, No. 2 is the means for "drying the mineral aggregate."

Specifications for Minneapolis Hot-Mix Asphalt Plant

THE engineering department of Minneapolis, Minn., has made an unusually thorough analysis of bids received from five manufacturers of asphalt plants for a hot-mix asphalt plant for that city; which bids, in turn, were based on unusually complete specifications. As a result the department did another unusual thing—it accepted the highest bid.

Prospective bidders were given a blue-print of the site on which the plant was to be located. The specifications called for a capacity of 75 tons per hour with a 1½-minute mixing time, requiring a 4,000-pound mixer and other features of the plant to coordinate with this capacity. Test runs of the plant were required before acceptance and a final test extending over a period of three months; and a bond in 100% of the contract price.

Bidders were notified that they were not restricted in any way in their design and specifications but could meet the city's requirements in the way each desired; but they were asked to show, by plans, illustrations and specifications, and details of the plant they were bidding on, each of the following features, in the order given:

1. Conveying the mineral aggregate into the dryer.
2. Drying the mineral aggregate.
3. Conveying the mineral aggregate to screens.
4. Screening the mineral aggregate.
5. Storing the mineral aggregate in separate bin compartments of 50 tons total capacity.
6. Weighing the mineral aggregate into separate sizes.
7. Conveying the filler dust to the weigh-box.
8. Weighing the filler dust in the weigh-box.
9. Storing the filler dust in the aggregate bin.
10. Conveying the mineral aggregate and filler dust to mixer.
11. Unloading the asphalt cement from tank cars.
12. Storing the asphalt cement. Storage capacity .... tons.
13. Heating the asphalt cement in storage by steam.
14. Conveying the asphalt cement to asphalt weigh bucket.
15. Weighing the asphalt cement and conveying into mixer.
16. Dust collecting system—to overcome the dust nuisance.
17. Power. Electric motors, speed reducers and transmission machinery.
18. Boiler (recommendation only). For asphalt storage pipe lines and steam jackets.
19. Temperature controls. Recording pyrometers.
20. Plant structure—Tower platforms, steps, guard rails and safety guards and housing.

Bidders were also notified that, in comparing the bids, the city would consider the price bid, the design, economy of operation, materials built into the design, the workmanship, and the fitness of the plant for the site.

Bids were received from five manufacturers ranging from $26,994 to $44,450.

Each bid was analyzed and a value given to each of the 20 items, composed of the sum of weighted values assigned to the six points—price, design, economy, materials, workmanship and fitness, price and economy of operation being given first consideration. The sum of the 20 credits so given to each bid formed the basis of comparison.

The highest sum of credits was found to fall to the highest bidder, and the engineers, to be sure they were justified in accepting this bid, made a further calculation and found that, based on the total amount of steel entering into the plant, the price of this per pound in the high-priced plant was less than in the lower-priced ones.

The dryer adopted was the double shell type. The asphalt storage and steam heating for asphalt cement were the composite type. The feeder to the dryer was of the automatic apron type.

N. W. Elsberg is city engineer, Frederick Paul is paving engineer, and E. M. Campbell is superintendent of paving.

Above—Bunk house at Yuba Pass. At right—Truck shed at Yuba Pass

Above—Donner Summit maintenance buildings. All photographed during winter 1931-32.

Keeping Open Road With a 30-foot Snow Fall

THE Division of Highways of California decided, in the fall of 1930, to endeavor to keep Donner Pass, on the Victory Highway through the Sierra Nevada range, open to traffic throughout the following winter, and it was kept open during the winter of 1931-'32 also.

This does not mean that traffic can pass at all times —there will be hours and days at a time when none will be allowed. For it has been found that traffic not only is seriously in danger on Donner Summit during a storm, but that its movement interferes with the progress of snow removal work, as the equipment must be operated at high speeds and there is scant time to lend aid to motorists who get into difficulties at this time. Therefore, early in November two sets of gates were erected across the highway, one on each side of the pass, and watchmen's shanties placed here and telephones installed. With the first sign of a severe storm the gates are closed to all traffic; to be opened again when the storm is over and the roadway has been cleared.

Some other states may think they have snow to handle in keeping highways open, but which of them have a snow fall of twenty to thirty feet in moderate winters, a sixty-year average of 33½ feet, and a maximum of 65¼ feet in one season—not drifts (they run into the hundreds of feet in the mountains), but official precipitation? This is the record for the Donner Pass, elevation 2500 at Colfax, 7135 at Donner Summit, and 5125 at the Nevada State line. Snow has fallen there at the rate of 8 inches an hour, and if there is a high wind, attempt to cross the pass would be extremely hazardous.

Snow removal work under such conditions requires not only special equipment but a road of high standard. It is impracticable to keep open a road with sharp curves, steep grades and narrow width, or one passing through deep cuts. So the state has for several years been getting ready for keeping Donner pass open by preparing the road. The plans of each project were reviewed with the thought to provide a road section most favorable for snow removal work. Wherever possible, the grade was established sufficiently above the adjoining surface so that advantage could be taken of the scouring action of the wind. Where it was necessary to go through cuts, the normal ditch section was widened and storage space thus provided for the snow which would be pushed off the traveled way. This widened ditch section also provides additional drainage when the snow melts, thus aiding in the upkeep of the road.

The surfacing placed on the road must be adequate not only to carry traffic, but to support the heavy snow removal equipment with a minimum of winter maintenance. In addition, the shoulders beyond the pavement must be of crushed rock to permit equipment to operate off the pavement when clearing snow.

There still remains one unit of this road not yet constructed to present day standards. This section is approximately twelve miles long, extending from Gold Run to Airport. The alignment is fair and a good oil surface has gradually been developed under maintenance which will carry traffic until the unit is reconstructed, starting early this year. However, the width and slopes make removal operations on this section more difficult than elsewhere on the road.

In preparation for this work additional equipment was obtained and allotted to Donner pass. The equipment at Donner summit consists of one "V" type and two straight-blade one-way speed plows, all mounted on 3½ ton four-wheel drive trucks, together with a shovel type rotary plow with "V" type blade mounted on a four-wheel drive truck and, in addition, an auger blower type of plow similarly mounted.

The truck shed at this point is of the roundhouse type and includes a repair shop with pits and tools to handle major equipment repairs. A sixteen-man bunk house is connected to the truck shed by a covered passage. Both of these buildings are constructed to withstand the coldest weather and are steam heated.

During the winter of 1931-'32, in spite of more than 200 inches of snow at high points around Soda Springs and in the Donner Pass, the pavement was kept clean and dry for more than three-quarters of the time, although there have been some brief intermissions caused by storms and slides.

The rotary plow was worked twenty-four hours a day every day, sunshine or blizzard, stopping only for fuel and oil. When one crew's time was up another was on hand to take its place. At night the

light was furnished by the machinery of the plow itself.

To keep open the approaches to the summit, there are stations at Colfax, Yuba pass, and Truckee. Each has a steam heated truck shed and bunk house, and oil house. At Colfax are two 3½-ton trucks equipped with 10-foot straight blade push plows, and a dual drive tractor grader equipped with a 10-foot grader blade and "V" type plow.

At Yuba pass are one "V" type and two straight blade speed plows mounted on heavy four-wheel drive trucks, as well as one auger blower type of plow mounted on a 5-ton four-wheel drive truck.

The equipment operated out of Truckee consists of two straight-blade push plows and one shovel type rotary plow, all mounted on 3½ ton trucks.

Effective snow removal work requires that the equipment start with the storm and continue until the storm has ceased and the road is clear. This means that the crews must be ready and equipment serviced, all in readiness for continuous operation for the duration of the storm. This fact accounts for the care and expense taken for the comfort of the men and facilities for housing and care of equipment. Crews are changed every eight hours.

A one-way speed plow, mounted on a four-wheel drive truck, has been found very efficient on depths up to two feet, and these are sent out at the beginning of a storm. When the snow depths average between two and five feet, the lighter truck-driven type of rotary is used. On heavier depths the work is handled with one-way speed plows, supplemented by truck-driven rotary plows, either auger-blower or shovel type. Sand mixed with a small amount of calcium chloride and applied with a mechanical spreader has been used successfully in eliminating icy conditions on the roads.

Other roads present similar conditions but on a reduced scale. Altogether the state used twenty 4-wheel and ten 2-wheel drive trucks, seventeen 5-ton and seven 10 -ton tractors, operating thirty-two push plows and seven rotaries of various types. During the 1930-1931 season over $92,000 was expended for the removal of snow at an average cost per inch-mile of $1.27.

The equipment and facilities provided cover some 600 miles of heavy snowfall area where there is normally sufficient snowfall to require the use of this equipment each winter to keep traffic moving. At any time of severe storms the division may be called upon to plow snow on an additional 1400 miles. The entire maintenance organization, with trucks, tractors, and graders, is available for such an emergency.

Highway men are continuously on the alert for slides, storms and obstructions. The roads are patrolled and machines moved rapidly to points where they are needed. Control stations require all cars using the road to wear chains, and drivers are advised as to the conditions to be encountered.

The state highways of California are divided into ten districts, each under the control of a district engineer, who has three assistants to handle the surveys, construction and maintenance within the district. Each district engineer is responsible for all work within his district to the state highway engineer, C. H. Purcell, whose active contact with the district engineer is through a headquarters staff, composed of a bridge engineer, construction engineer, engineer of surveys and plans and maintenance engineer.

Snow removal is under the direction of the headquarters maintenance engineer, though directly handled by the district maintenance forces under the direction of the district maintenance engineer. To each district is assigned the necessary snow removal equipment, which always remains under its control. Snow territory is divided into 100-mile sections, each section being supervised by a district maintenance superintendent. These sections are divided into three or more units, with foremen, truckdrivers and laborers assigned to each unit. Housing facilities are provided for both men and equipment at appropriate locations.

As many of the roads which are kept clear of snow are not through but recreational routes, snow removal on these could not be said to be justified from the standpoint of gas tax returns. However, there is an interest in snow sports, and the financial returns well warrant the expense.

High Early Strength Cement Test Pavement

The Board of Public Roads of Rhode Island has constructed a short section of high early strength pavement involving the use of five brands of high early strength cement. The age of the specimens has been carried well beyond the time of early opening and will afford some information as to the action of these cements over longer periods. At present, practically all of the cements have lived up to the claims of the manufacturers and readily meet the Board's specifications for this type of cement.

Cost of Chlorine-Ammonia in St. Paul

The water commission of St. Paul, Minn., began using ammonia in connection with chlorine in October, 1930, and continued it through 1931. The ammonia was applied in the form of ammonium sulphate, for which no additional mechanical equipment was required. This use of ammonia resulted in an increase in odor removal from an average of 80 percent to an average of 92 percent.

Comparing the cost of chlorination for the first nine months of 1930 with that of chlorine-ammonia treatment for the corresponding period of 1931, the cost is found to be the same—30 cents a million gallons. The cost of the aluminum sulphate used was $1.52 per million gallons.

Manicuring Sidewalks in New Orleans

Canal street is the main business thoroughfare of New Orleans. In 1930 the abutting property owners relaid the sidewalks, which are 21 feet wide, on both sides of the street for a mile in length, with terrazo divided with inlaid brass strips.

In an endeavor to maintain these as clean as possible, the Canal Street Association, consisting of merchants and property owners along this street, purchased the cleaning supplies necessary for a period of one year at a cost of approximately $4,000, the cleaning being done by the city forces. This is done in the late hours of the night and consists of hosing the sidewalks, scrubbing them with a chemical compound, squeegeeing and drying with buffers. Occasionally a seal coat is placed over the surface to render it impervious to stains.

Adairville Reduces Insurance Costs 30%

By C. N. Harrub, B. S.
of C. N. Harrub Engineering Co.

THE Town of Adairville, Kentucky, for several years has suffered from an inadequate water supply. The water had been obtained from a small spring, from which it was pumped to an elevated tank located in the square. The distribution system consisted of galvanized iron pipe of small size, much of which was badly corroded and incapable of giving satisfactory service. Both the available quantity and the facilities for handling were inadequate, and the town was unable to get better than tenth class rating from the Actuarial Bureau.

For several years attempts were made to finance improvements to the system, but the town was unable to do so until after the passage of the Water Revenue Bond act in 1930, when a bond election was held for the purpose of voting as many water works bonds as the law would permit, with the idea of issuing water revenue bonds to take care of the remainder of the cost of the improvements. The election was held in November, 1930, and carried, and the trustees of the town engaged the writer's firm for making estimates of cost, preparing plans, etc., and estimates were submitted to the trustees January, 1931. On the basis of these estimates the board decided to issue $25,000 of water revenue bonds.

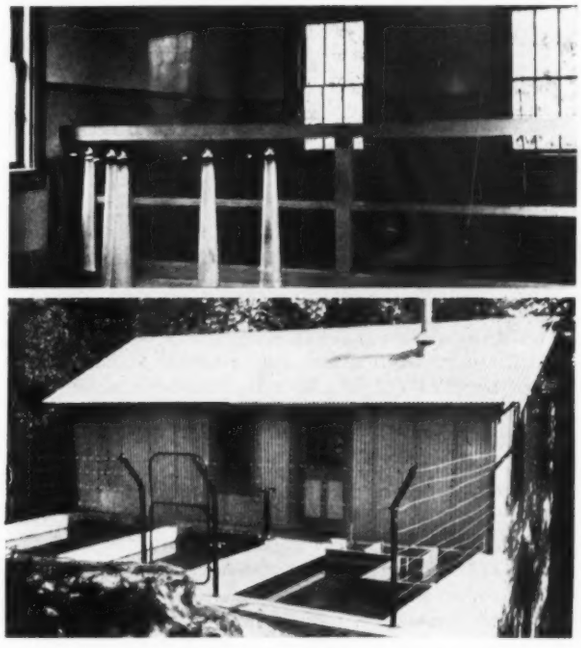
From the start it was evident that no part of the old system would be usable in the new, and a complete new system was designed, with the intention of abandoning the old as soon as the new was ready for service. Before the trustees could complete the necessary legal proceedings relative to issuance of bonds, the bond market fell off, and when the bonds were advertised for sale no bids at par were received. This necessitated advertising the job to be paid for with bonds, although contractors usually bid higher for work so paid for. It was feared, therefore, that no bid within the bond issue would be received but contrary to expectation, such bids were received and contracts were awarded.

The plant as built consists of a river intake, two low-lift pumps, concrete sedimentation basin, concrete filters and clear well, two high-lift pumps, filter building, dry-feed chemical machine, chlorinator, distribution system with fire hydrants, and elevated tank. The low-lift pumps were installed in the same building as the filtration plant, a section at one end of the clear well being cut off as a low-lift pump pit. This arrangement permits all pumps to be housed in the same building, convenient for the operator.

The distribution system consists of cast iron pipe ranging in size from 2″ to 8″ in diameter. There are twenty-five fire hydrants with 4″ and 6″ connections. All house connections from the main to the property lines are of copper tubing.

There is a 50,000-gallon tank on a 100-foot tower in the northwest corner of the town, which is its highest point. This results in an extremely good pressure all over town.

The total cost of the plant exclusive of house connections was $40,353.66. This figure included all costs for advertising, legal expense, real estate, engineering fees and incidentals. For purposes of analyzing the cost it is divided into items as follows:



Interior and exterior views of Adairville filter building

	Total	Per capita
Intake	$ 170.56	$ 0.189
Filtration plant	10,555.50	11.728
Pumping equipment	2,016.57	2.241
Distribution system	22,322.78	24.80
Elevated tank	5,288.25	5.876
	$40,353.66	$44.834

The population of Adairville for 1930, the last year for which figures are available, was about 900, on which basis the per capita costs are as shown.

As a matter of fact, the plant as equipped will serve 1200 people. By equipping the second filter at a cost of $3,000, the plant will be able to serve at least 2300 people, when the cost per capita would be reduced to $18.85, of which 7 cts. is for intake, $5.90 for filtration plant, $0.88 for pumping equipment, $9.70 for distribution system and $2.30 for elevated tank.

An important part of the return recived by the town for this expenditure is in the form of lowered fire insurance rates. The plant was designed and constructed to meet the requirements of the Kentucky Actuarial Bureau for eighth class rating, thus securing a reduction in base rates of 30 to 35 percent—more than enough to offset the increase in taxes required to provide for interest and retirement of bonds, and therefore saving money for taxpayers who own insured property.

The design of the plant was by the writer's company, the C. N. Harrub Engineering Company, of Nashville, Tennessee. The general contractor was the Bush Building Company of Nashville, Tennessee. Pumps were furnished by the Worthington Pump & Machinery Corporation of Cincinnati, and the elevated tank by the R. D. Cole Manufacturing Company of Newnan, Georgia.

Mechanical Equipment in Sewage Treatment Works

By A. Prescott Folwell
Editor Public Works

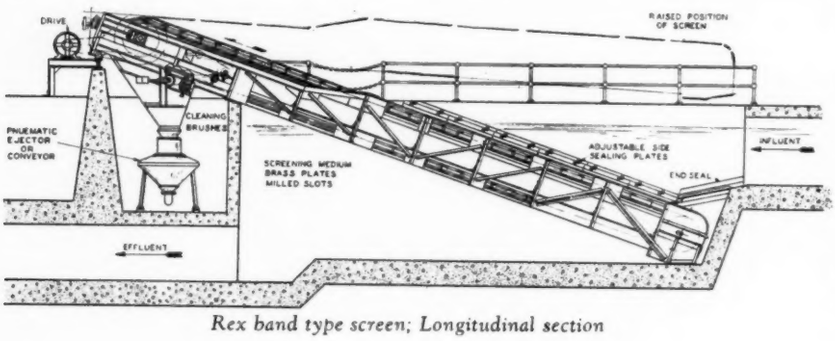
II–Fine Screens *(Continued)*

Band Screens—Of band screens, at least two different kinds have been used in this country. A Brunotte screen installed at St. Petersburg, Fla., consisted of aluminum bars about two feet long serving as links in a link belt; about sixty parallel bars, spaced about ¾" apart in the clear, forming each link, which was 5 ft. 10 in. wide. (This spacing really makes this intermediate between a fine and a coarse screen.) The belt or band moved at a speed of ten feet per minute. Screenings were removed by a rubber-toothed comb. It screened 20 m.g.d of sewage. This screen was made by the Link Belt Co.

The other kind consists of a number of screens connected into a belt by flexible joints. What is known as a Jennings screen was installed in the Chicago stock yards in 1913. It consisted of separate sections of removable screens of monel metal, 40 meshes to the inch, and was cleaned by blowing the screenings off by compressed air under 1½ lbs. pressure.

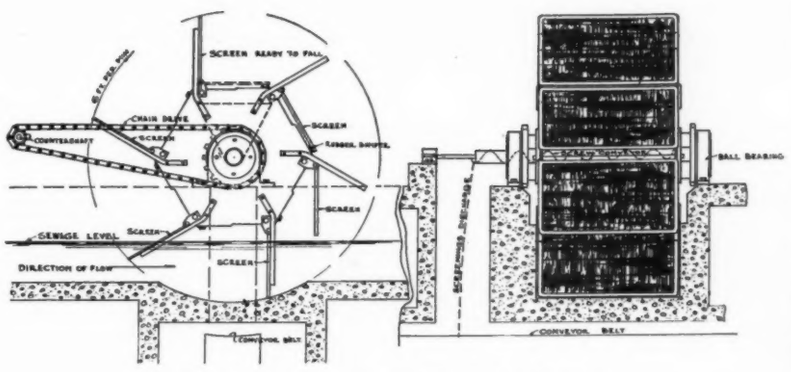
In the Rex screen, made by the Chain Belt Co., each unit or link consists of a 3/16 inch brass screen plate with milled slots; a number of these being mounted on two strands of 18-inch P steel bushed roller chain equipped with 6" diameter single flanged rollers, which travel over a set of two foot sprocket wheels and two head sprocket wheels, driven by a 3½ to 7½ h.p. variable-speed motor. This gives a wide belt through which the sewage flows; the belt being under the sewage 44% of the time of travel from bottom to top; and above the sewage, so that the screenings can drain 56% of the time. The speed of travel can be varied proportional to the sewage flow for accumulations of screenings. As the successive plates pass over the top sprocket wheels the screenings are removed from them by revolving brushes and discharged into cans, hoppers, or conveyors. The screen is installed in a straight channel and adjustable side seals reduce the clearance to not more than the width of the screen slots. In a New York installation there are three of these screens, each 7' 10½" wide and 46' 6" between centers of sprockets, inclined 20° from the horizontal; the slots being 3/64 inch wide by 2 3/16" long and giving clear openings totaling 14% of the entire area. The capacity of each unit is 15 m.g.d. During 1930 each screen handled an average of 8.25 m.g.d.; from each million gallons was removed an average of 1625 pounds of screenings with a moisture content of 73%, this being 27% of the suspended solids.

Rex band type screen installation

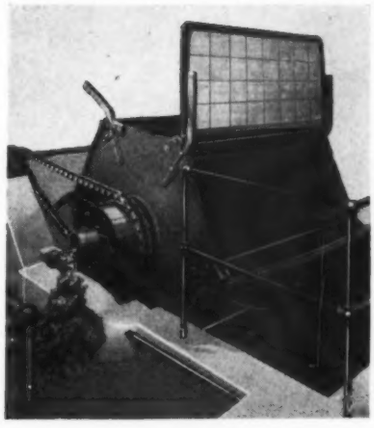


Rex band type screen; Longitudinal section

Wing Screens — A wing screen known as the Hankin has been installed in some Canadian plants. This screen has six wings or panels mounted on hinges on a hexagonal steel plate drum revolving on roller bearings. Each panel has an effective area of 5' 0" by 18". The screens are made of heavy steel welded

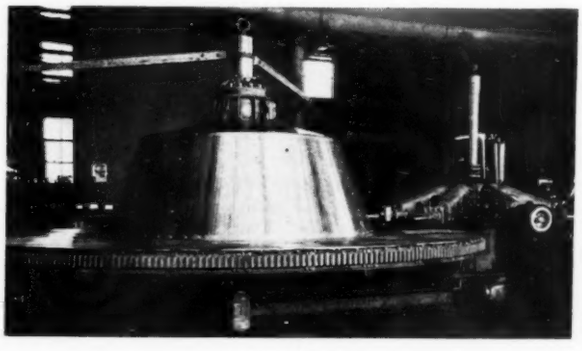


Hankin wing screen, cross-section and end view



frames with ⅛" square mesh galvanized iron wire filling reinforced with ½" steel wire. The outer edges of the panels are fitted with rubber so as to completely fit to the channel sides and bottom.

The drum is revolved so that the panels are propelled in a direction opposed to the sewage flow. As the panels rise slowly out of the sewage the screenings which are spread on the surface lose a large part of their water content by draining. As each panel reaches the top of its orbit, its balance is lost and it falls on to a laminated steel bumper bar provided with rubber cushions. The shock discharges the material off the screen panel into a receiving hopper inside the drum and a screw conveyor pushes it to the side of the screen into wire baskets or into conveyors or presses.



Disc Screens

When the July installment, describing fine screens, went to press we had no illustration of a disc type of screen available. We now show one, as made by the Shevlin Engineering Co. This is seen to resemble closely the original Riensch-Wurl screen, but is claimed to be more rugged in construction, using standard structural shapes, while a sloping underslung holder with bronze sealing rings is said to increase by 60 to 100 per cent the efficiency in removing suspended solids.

III—Disposal of Screenings

Coarse Screenings consist largely of sticks, rags, paper and other large suspended matters, often combined with more or less grease, fecal matter, and other solids which make the mass objectionable to sight and smell. A few minutes' draining will generally make these screenings readily combustible, with additional fuel needed only for starting combustion if at all. In many small plants the screenings are burned in piles in the open or in small incinerators. Ordinarily there would need to be little offensive odor except when the fire is starting or stopping; and wood, oil or other fuel should generally be used at the end as well as at the beginning. Avoidance of the odors of a smouldering fire is much easier when a suitable incinerator is used.

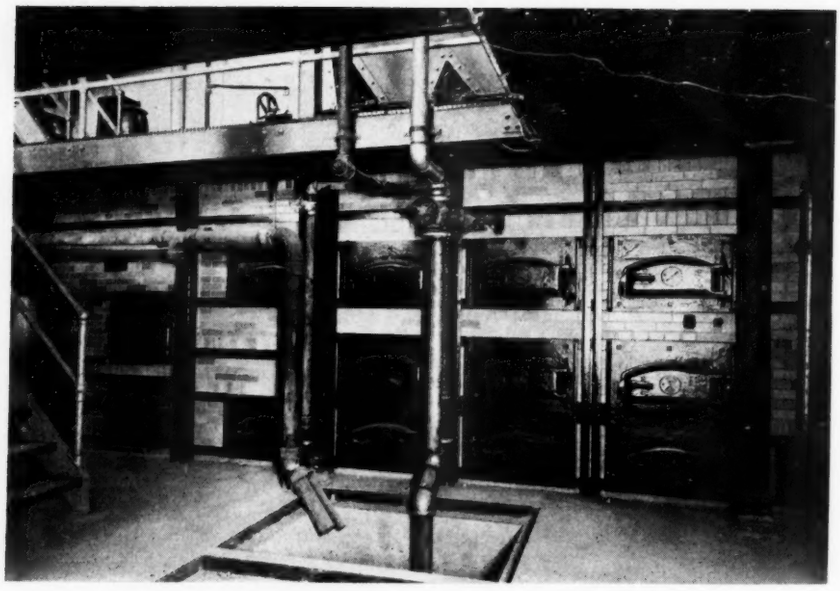
Coarse screenings are sometimes simply dumped near the plant, but are apt to putrefy and are objectionable to sight. If buried in trenches or covered with ashes or earth as soon as dumped, these objections may be eliminated.

Fine Screenings contain generally about 10 to 25 per cent of the suspended matter in the sewage, mostly organic, including paper, match sticks, cloth, spent grain from home brew, corks, etc., with a considerable amount of fecal matter. They are generally 90 to 96 per cent moisture, and settle into a soggy mass which putrefies abundantly and is difficult to handle.

They can be disposed of by burying in the soil in trenches, or used on the soil as fertilizer; can be lagooned and dried slowly by evaporation and draining; placed in digestion tanks; dried on sludge beds; or burned. A few cities dispose of them by transporting to sea or other deep water; others by making into dry fertilizer.

For manufacture into fertilizer, and sometimes for burning, the screenings are dewatered in one of several ways, which will be described later.

Burning properly performed is undoubtedly the most satisfactory method of disposal, and apparently the only one possible near human habitations, other than drying, which is very expensive. Incineration disposes of everything, before putrefaction begins, and leaves nothing but ashes. If all gases from the burning screenings be brought to a temperature of



Screenings incinerator at Mamaroneck, N. Y. Morse-Boulger

1250° to 1400° no odors will escape from the chimney. Fine screenings are much more compact than garbage, and an incinerator that might be a success in burning the latter might be a failure with the former. (See "Incineration of Sewage Screenings and Sludge" in PUBLIC WORKS for May, 1932).

Incineration

Screenings ordinarily have a heating value of about 5,000 to 8,000 B.t.u. per pound of dry material and can be dewatered to the point where they will burn without auxiliary fuel, but it is apparently less expensive to use fuel and reduce the amount of preliminary dewatering. There will be a point of minimum total cost of combined dewatering and incineration, which will vary for different sizes of plant, composition and nature of screenings, and design of furnace and dewatering equipment. The fuel may be oil, gas, or pulverized coal, depending chiefly on which is cheapest in the locality in question. In general it may be said that it will require about 12 to 25 gallons of fuel oil per ton of screenings of 70% moisture, up to 30 to 45 gallons for 95% moisture, for different makes of plant, with preheaters; and from 24 to 44 gallons for screenings with 70% moisture up to 37 to 65 gallons for 95% moisture if there is no preheater. With gas, the numbers of cubic feet are about 300 times the gallons of oil required for similar moisture contents. These figures allow for extra fuel in starting and after charging and stoking; at other times the amounts will be 15 to 20 per cent less than the figures given. The capacity of a furnace is but slightly affected by variations in moisture content.

Fine screenings are so compact that it seems impossible to pass flames through them, and they can be burned only on surfaces exposed to the heat, and for a depth of only an inch or two. Therefore they are spread in thin beds on a grate or hearth and worked over by stoking, pulling onto another grate, or other method, to expose fresh surfaces to the flame. To prevent odors escaping from the chimney, all gases given off must be kept at a temperature of not less than 1250 to 1400° F. for a long enough period to effect their entire and complete combustion.

Incinerators for burning screenings have been used occasionally for years, but during the past two or three years they have been coming into more common use. One is said to have been installed in Washington, D. C., in 1909 by the Decarie Co. . . . In 1924 Long Beach, Calif., built one of the Dutch oven type, and in 1926 an additional unit for incinerating about two tons a day. A charge of 2,000 to 4,000 pounds of screenings of 85% to 88% moisture was dumped onto one end of a 4 ft. by 8 ft. grate of cast-iron fire bars with ⅜ in. air spaces, and combustion started with natural gas, air being supplied with a blower. Water from the screenings drained into an ash pit below. When the screenings on top were burning freely they were raked to the rear of the grate, and later onto a fire-brick bed 5 ft. by 6 ft., at the same level as the grate, where combustion was completed. This was repeated about twice an hour until all the screenings were incinerated. On their way to the chimney the gases passed through a combustion chamber of which the aforesaid fire-brick bed or hearth was the floor. The cost of the improved unit described above was $2500. A somewhat similar one was built at London, Ontario, about two years ago.

Two of the latest and largest incinerators are those built at South Yonkers, N. Y., for the Westchester County Sanitary Sewer Commission in 1931; and others are being built for the commission in two other plants. Milwaukee this year let a contract for an incinerator for burning screenings and grit. Cleveland has contracted with the C. O. Bartlett & Snow Co. for one in which screenings, skimmings and grit will be burned on a drying hearth of carborundum brick. When there is no grit (which melts into a clinker under the intense heat) the other materials will be burned on a grate after having been dried on this hearth.

The South Yonkers plant contains two incinerators which have been in regular service for about a year, each with a capacity of burning a ton a day of screenings of 70% to 85% moisture. One, a Decarie furnace, has two grates of parallel water tubes and two of cast iron; the other a Morse-Boulger, has two hearths of fire brick. Both connect to a common flue and regenerator. Both use fuel oil with burners of the atomizing type; each having an auxiliary burner located beyond all grates and hearths for insuring complete combustion of gases. Regenerators permit the heating of air supplied for combustion.

The screenings are brought by ejectors or conveyors to bins over each incinerator, from which they are discharged into charging holes in the top of the

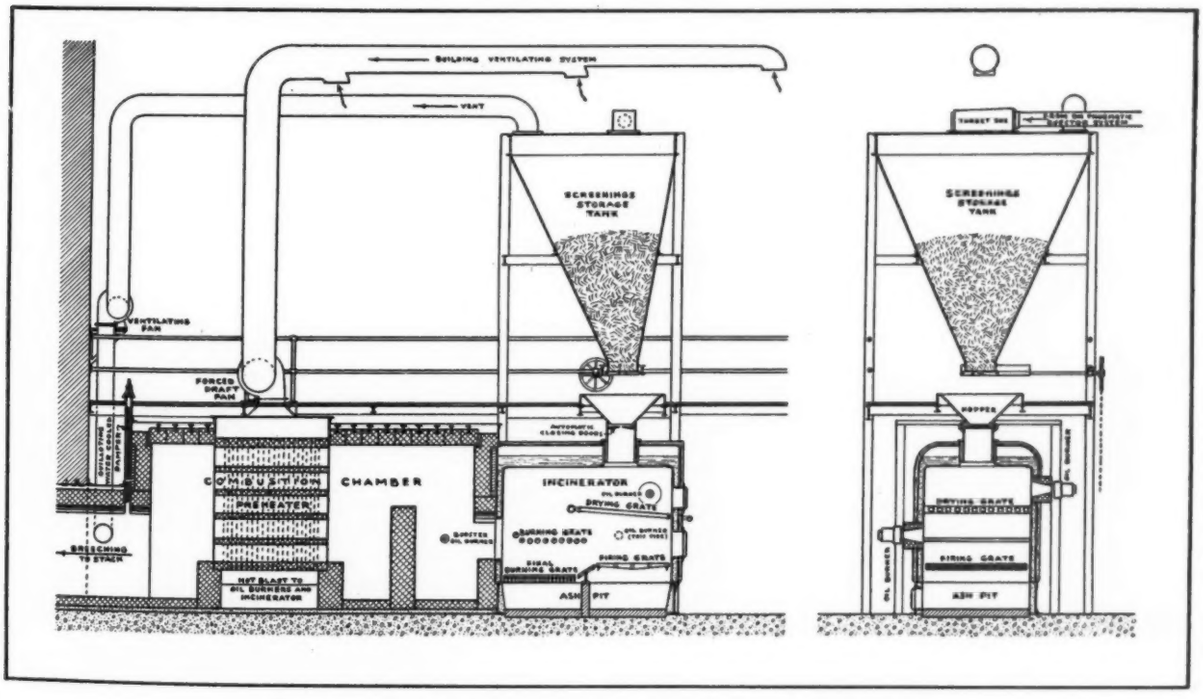
furnace. The stoking is done by one man, while a helper assists in charging the furnaces, caring for auxiliary apparatus and cleaning up. As 1400° is set as the minimum temperature for the combustion chamber, and the temperature falls whenever the doors are opened for stoking, the average temperature is kept several hundred degrees higher than this.

The Morse-Boulger furnace consists essentially of two refractory hearths, one above and slightly overlapping the other. Screenings are charged onto the upper through three charging holes and spread into a thin layer by the stoker. All the heat from one of the burners passes directly over this, down to the lower hearth (being diverted by a curtain wall), back across this hearth, around its end (where there is another burner) and under it to a settling chamber. Screenings on both hearths are thus exposed to heat both above and below, and the abrupt reversals of the gases insure thorough mixing with the air, and travel through a long, heated zone gives them time to burn. When the screeings on the upper hearth have been partly burned they are pushed over onto the lower hearth, where incineration is completed. An iron grate under the upper hearth permits use of coal or other solid fuel if desired.

The outer structure consists of a steel frame-work and brick walls. An air space is left between this and the interior fire-clay lining, for which are used special fire clay brick, better suited than commercial fire brick for withstanding the high temperatures and sudden cooling by charges of wet screenings. These destructors are made down to a capacity of 65 pounds an hour; there would be practically no saving in construction or operating cost to make them smaller. The 2000-pound South Yonkers furnace is 25 ft. long, 8 ft. wide and 9 ft. high. It burns 25 gallons of No. 6 fuel oil per ton of screenings of about 80% water content, without preheating the combustion air.

The Decarie incinerator is 23 ft. long, 8 ft. wide and 9 ft. high. The grates are formed of parallel tubes carrying water for cooling them, which are connected to headers. The steam resulting can be used for any desired purpose—power, heating, etc.—or can be blown off. The upper water-cooled grate receives the charge of screenings through a self-closing hopper, and when these have partly dried and begun to burn they are stoked onto the lower water-cooled grate at the rear of the furnace, some burning material falling through the upper grate onto a cast-iron grate beneath. Oil flames attack the material, one from above the upper grate, another below the upper grate and above the lower. On the second water-cooled grate the material continues to burn as the heat and flame pass both above and below it on their way to the gas combustion chamber. Material on the second grate is worked through this onto a lower cast-iron grate where it burns under forced draft delivered from the ash pit below. If it is desired to use coal instead of oil, the lower front grate can be used for that purpose. There is no fire brick whatever inside the furnace, the whole being water jacketed. Immediately in the rear of the furnace is the combustion chamber of fire brick walls, baffle walls and dust collectors. All gases from the combustion chamber pass through a refractory preheater, which delivers air for combustion at 300° to 500°F. Air used for combustion is vented from the room and storage tank.

The Decarie Incinerator Corporation informs us that it has recently developed a special furnace for burning combinations of sewage screenings, grit, grease and skimmings from tanks, all in one unit. In burning the grease and oil, the steam generated in the water-cooled grates is used in atomizing and heating the grease before it is introduced into the furnace.



Decarie sewage screenings incinerator: Longitudinal and cross sections

Blasting vs. Excavation Through Swamps

DURING the past two construction seasons, the State Board of Public Roads of Rhode Island has been trying out explosives for accelerating the complete settlement of fills over swamps, thus allowing the placing of permanent pavement during the same construction season and avoiding the building of temporary wear surfaces. The results of the work are reported by the Board as follows:

"Our first major attempt to settle a new fill was over Sand Hill Pond on the Post Road. Here we had a ten-foot fill some six hundred feet long over a pond-hole in which the mud varied from six to twelve feet in depth. Our plans called for blasting under the fill as it was being made, thus forcing the muck out to the sides and allowing the filling material to replace this muck. No effort was made to remove the top growth, which appeared light and not capable of sustaining much load. After a year of service we find that our method was successful except for a short stretch at the junction of the swamp and hard ground. Here evidently the excess matted growth had formed a raft which floated the fill and prevented complete settlement of the filling material.

"Our second settlement job was done at about the same time as the Sand Hill Pond job. In this case a four-foot fill some ten hundred feet long was made over a swamp containing about six feet of muck, which was blasted in the above manner. The results were practically the same as in the first case. Complete settlement was obtained over ninety-five per cent of the fill, with one fifty-foot stretch at the end settling slightly under traffic.

"During the past season we encountered bad swamp conditions on two projects. On Federal Aid Project No. 65-A, South County Trail, a swamp varying from four to twelve feet in depth of muck and about five hundred feet long was covered with a heavy grass mat. In this case we blasted this mat by a series of shots fired by the propagation method. This not only broke up the stiff top but liquefied the muck in the swamp for a depth of about three feet. Then we blasted underneath the fill while the material was being placed, thus forcing the muck out at the sides. Wherever local soft or spongy places showed in the fill, a further blasting was done. Levels on this fill taken at two-week intervals through the summer showed only normal settlement and the new pavement was built on it last fall.

"Another swamp and fill calling for special treatment occurred on the new section of the South County Trail, Federal Aid Project No. 65-C. In this case the muck lay on an inclined plane varying from four to ten feet thick in a width of fifty feet and for approximately one hundred fifty feet in length. Through this location there was a heavy growth of trees and their roots formed a heavy protective mat on the swamp. A six-foot fill was called for. Our effort in this place was directed towards stabilizing the settlement by excavating a core on the low side and backfilling with heavier material which prevented the muck from sliding sideways when the load was applied.

"If fills can be successfully made by the blasting method, a considerable saving in cost is effected, for the cost of blasting by the propagation method is less than one-third the cost of excavation."

Suggestions for Preparing Specifications

The following suggestions have been made by the Du Pont Co. to aid highway officials in preparing specifications for projects involving the use of explosives for the settlement of embankments. Heretofore contractors have been somewhat at a loss in preparing bids, because of the lack of specific information, while engineers encountering this type of problem for the first time are also at a loss in knowing exactly what information should be furnished to the contractors.

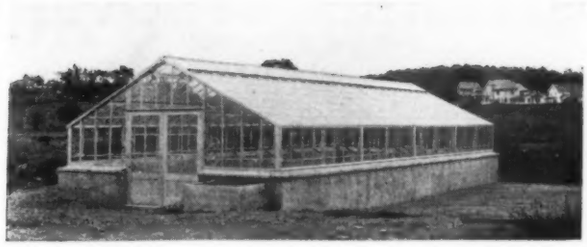
Highway officials, in preparing specifications, should consider the following points:

1. The furnishing of a sub-surface profile together with cross sections, or the furnishing of a record of soundings sufficient to cover the work involved.
2. The prescribing by the engineer of only the most general method of procedure, but requiring the contractor to state the method he expects to use.
3. A provision for a test of the method decided upon in order to check the success such method will produce.
4. The naming of the type or types as well as strengths of dynamite to be used.

In other words, the engineer should prepare all preliminary soundings and sub-surface profiles so that the amount and distribution of yardage involved will be definitely known. The contractor in submitting his bid will be required to state the method he expects to follow to accomplish the work as well as the type and strength of dynamite he expects to use. By providing for a test, the engineer will be able to determine if the plan of action decided upon will accomplish the desired results.

There are so many variables entering into fill settlement blasting that it is difficult to draw up in advance any set of hard and fast rules which will exactly define just what will constitute a satisfactory accomplishment of the project. Because of this and the fact that the finished work is literally out of sight, many engineers prefer to retain direct supervision of all blasting. The most successful jobs of which there is record are those wherein the contractor handled the work on the basis of so much per pound of dynamite used. As time goes on and engineers and contractors become familiar with this type of work, the drawing up of specifications and requirements will become more clearly outlined, and many of the present difficulties will be overcome.

Insuring Glass Covers for Sludge Beds



Glass-covered sludge bed, Sparta street plant, Newton, N. J.

A CITY official asked us whether it is customary to insure glass covers, which are being used so generally over sludge beds (and in some plants other units as well). We have passed the inquiry on to engineers who have designed such plants and firms that build them, and are surprised at their dearth of information. Of a dozen engineers, as many cities having such houses, and three greenhouse builders, none of the engineers or builders had any definite information and only two cities could give us figures.

Stanley Shupe, city engineer of Kitchener, Ont., informs us that that city has 32,000 sq. ft. of glass, in 16x24 plates which cost 30 cents each. This is insured against any damage from weather (presumably hail and wind) to a total value of $2,400 at an annual cost of $59.25.

The glass-overs of the Marion, O., sludge beds have been insured for seven years past, according to F. G. Browne, sanitary engineer. An annual premium of about $200 is paid for hail and wind damage to these and also to all of the plant buildings and fire insurance on their contents; the total amount being about $65,000. Mr. Browne understands that the insurance companies will not insure the glass-overs alone but require inclusion of the other buildings to cut down the rate. In the case of the glass-overs, the glass is insured at one rate and the frame at a lower one. During the seven years the city has had a claim of only $50, for damage due to wind.

Ithaca, N. Y., applied for insurance, but the rates seemed so high they decided to carry the risk themselves.

Engineers generally believe such insurance desirable. One says that hail insurance for the full value of the glass is desirable, but he believes that very little such insurance has been taken out in his state (New Jersey). Another suggests boy-with-stones insurance also.

Robert N. Clark, of the King Construction Co., writes that, of five municipal plants near Buffalo, N. Y., three carry no such insurance and the other two are protected by a special clause in their general policy (which covers the entire plant) against damage by hail, covering the entire cost of the glass. Said Mr. Clark: "As a general thing, glass enclosures suffer very little damage except in severe hail storms which might occur with a frequency of five to ten years. We also have a record of one failure due to a tornado striking a partially erected house. Glass enclosures suffer practically no damage, even during the height of a gale. We have several instances of green houses and sludge beds going through a gale of 70 to 90 miles per hour velocity without any damage whatever."

J. C. Gorman, of the Lord & Burnham Co., says that "From the writer's experience of twenty-seven years, he has only heard of one greenhouse structure that was struck by lightning. Furthermore the modern sludge bed has practically no amount of wood in it to burn. . . . There is nothing in the interior of the bed that would be damaged." Therefore fire insurance seems unnecessary, and moreover it is inordinately high. "As we see it," says Mr. Gorman, "a sludge bed really should be protected only against the loss of the glass, by either hail or wind. The structure itself we do not think could possibly fail. . . . After the glass is out there is absolutely no resistance to wind left."

Insurance agencies seem to agree that most insurance of greenhouses against hail is carried by the Florists Hail Association of America, whose rates are as follows, based on 14c per sq. ft. coverage rate:

Zone A—All states east of the Mississippi river: 7.5 cts. per 100 sq. ft.

Zone B—Minnesota, Washington, Missouri, Louisiana, Utah, Idaho, Oregon, California, Arizona and all of Iowa except the western tier of counties: 10 cts. per 100 sq. ft.

Zone C—Montana, Wyoming, Arkansas, Oklahoma and Texas: 15 cts. per 100 sq. ft.

Zone D—North Dakota, South Dakota, Nebraska, Kansas, Colorado, New Mexico and the western tier of counties of Iowa: 20 cts. per 100 sq. ft. In addition, a membership fee is paid at time of entry (but not for renewals), which is $3 for the first 2,000 ft., plus 50% of the basic assessment on additional area for Zone A, 40% for Zone B, 30% for Zone C and 25% for Zone D.

The above is for double-strength glass; rates for single-strength are double these. A discount is allowed for houses with approved wire screening.

Windstorm insurance on greenhouses is quoted by the Pennsylvania Lumbermens Mutual Fire Insurance Co. as follows:

"Windstorm insurance on glass must be written under a blanket form with a full co-insurance clause (100%). In other words, an assured must carry insurance equal to the full value of his glass. The rate on this class of insurance is $7.50 per thousand per year, and on policies so written a dividend of 25% is returned at the expiration of the policy. Insurance for a period of three years can be written at a cost of two and one half times one annual premium, also subject to a dividend of 25%"

To Remove Oil or Tar From Automobiles

"Apply a mixture of one part lubricating oil to four parts of gasoline. Allow this to remain on the splattered surface for about five minutes, then wash off with mild soap and water. This should be done before the oil or tar has hardened."

Practical Concrete Construction Details

By William E. Barker
Highway Engineer, Portland Cement Association

III—Proportioning Aggregates

Proportioning is the determination of the quantities of ingredients that will be mixed to make concrete. Of the many methods that have been proposed for determining or specifying proportions, four are outstanding, two of which will be described in this article.

The factors governing proportions are: the strength needed; the quality of concrete required to withstand the exposure to which it will be subjected; the workability necessary to assure the surface desired, economy of placement, bond with the steel and filling of corners in forms; economy of materials and labor.

Arbitrary or Fixed Proportions

Arbitrary proportions state exactly the quantity of each ingredient in the concrete. The proportions may be stated in terms of weight, volume, or absolute volume, which is total volume minus voids, but if they are based on arbitrary assumptions, rather than on a study of the particular materials to be used, they are arbitrary proportions. The 1:2:3½ mix, for example, is an arbitrary proportion widely used for pavements.

A modified arbitrary proportion is one which fixes the total quantity of aggregates to be used per unit of cement, but allows adjustment of the proportion of fine to coarse aggregate to get a desired workability. One part of cement to 5½ parts of fine and coarse aggregate, measured separately is a modified arbitrary proportion corresponding to the paving mix cited above.

The proportion of water may also be specified, and the minimum quantity of cement per cubic yard of concrete.

Arbitrary proportions were originally based on the average voids in fine and coarse aggregate, which were found to range from 30 to 50 per cent. Fine aggregate was therefore commonly made 50 per cent of the coarse aggregate and, in the richer mixes, cement was at least 50 per cent of the coarse aggregate.

For such mixes it was necessary that aggregate contain nearly all sizes, from coarse to fine, or the concrete would prove harsh and unworkable, so aggregates were required to come within certain limits of grading.

In later years the importance of water has been recognized and it has also been included in the proportions, the amount permitted being the minimum that experience indicates will give the desired consistency with the least favorable of the acceptable aggregates.

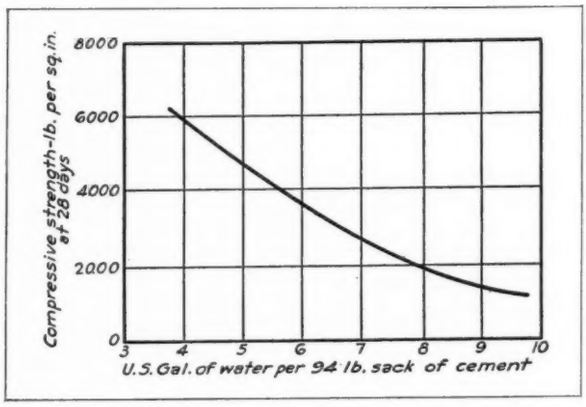
Proportions stated by absolute volume is the newest form of arbitrary specification. It has the advantage of easy conversion into weight proportions, by calculation from the specific gravities of the aggregates, and, for a given quantity of water, of constant cement factor, regardless of weight or grading of the aggregate. Its chief disadvantage is the effect of poorly graded aggregate. Even though the absolute or solid volume of aggregate remains the same, a poorly graded aggregate would have a larger bulk than one that was well graded, and would require more sand to produce a workable mix, but with fixed proportions this could not be provided.

This difficulty can be avoided by specifying the absolute volume of mixed aggregate and allowing adjustment of the proportions of fine to coarse material to get the desired workability. The author considers this the ideal form of arbitrary specification.

One absolute volume of cement to 2.6 absolute volumes of fine and 4.1 of coarse aggregate would be an absolute volume specification corresponding approximately to the 1:2:3½ paving mix already cited. The modified arbitrary form of this specification would be one absolute volume of cement to 6.7 absolute volumes of fine and coarse aggregate.

Excellent concrete has been and can be made with arbitrary proportions. In fact, most of the concrete in the world has been proportioned in this manner. Its advantages are simplicity, a definite understanding by the contractor of what materials will be required before the contract is let and the experience gained by architects, engineers and workmen from years of use.

Its disadvantages are: inability to use aggregates unless they conform to a recognized grading; frequent over or under sanding of mixes, with resultant honeycomb and strength reduction; uneconomical mixtures; strength and durability not predetermined. They are sufficient to warrant the exclusion of arbitrary proportions from jobs of any size or importance.



Water Cement Ratio Proportioning

The quality of concrete is determined by the quality of the cement paste which binds the particles of aggregate together. The quality of the paste depends upon the amount of water it contains—the more it is diluted the weaker and less durable it becomes.

The strengths which will result from different proportions of water to cement have been determined by test. They are indicated on the accompanying chart. In proportioning by water-cement ratio the desired strength is first decided upon and the corresponding quantity of water per sack of cement is picked from the chart. The proportions are then determined by trial batches. The water and cement are mixed to a paste and fine and coarse aggregate are added to the paste, until concrete of the desired consistency and workability is secured. The proportions determined in the trial batch are used on the job until a change in aggregates, or in strength or consistency desired, make a new proportion necessary, when new trial batches are made.

Some cements harden more rapidly than others. Mixing time, type of aggregate, and other minor job conditions have some influence on the strengths secured on an individual project. The strengths indicated in the chart are average strengths found in laboratory tests. Strengths secured on a given job may be slightly above or below those shown. On a job of any size it will be worthwhile to determine this difference and plot a new water-cement-ratio-strength curve which applies to that particular job. That is done by making test specimens under job conditions, using about three water-cement ratios. With the strengths of these specimens, a new curve is plotted which should be parallel to and either above or below the average curve on the accompanying chart. This job curve is then used in determining the water-cement ratios for that particular job.

The water-cement ratio determines strength only when the concrete is plastic and workable. Mixes that are excessively dry or harsh, or undersanded, so that there is honeycomb in the concrete, will not have the expected strengths.

All of the water that can dilute the paste must be included in calculating the water-cement ratio. The water on the surface of the aggregate must therefore be counted along with that actually put into the mixer. Any water absorbed by the aggregate within 30 minutes after the concrete is mixed does not dilute the paste, and need not be counted in determining the water-cement ratio. The amount of water on the surface of the aggregate is determined by daily tests. Absorption is also determined by test but can only occur when surface moisture is zero.

It frequently happens that durability requirements, rather than strength, limit the water-cement ratio. The water-cement ratios for durable concrete subjected to various degrees of exposure were given in the June issue. They should not be exceeded, even though the strengths then secured are above those required.

THE EDITOR'S PAGE

Opportunities for Public Works Through Federal Aid

Under the unemployment relief bill, $300,000,000 is allotted to states, which amount may be used for relief or for work relief. This sum may be used for highway and street work, water supply, sewerage, and other projects, largely at the option of the state. The $1,500,000,000 to be loaned by the Reconstruction Finance Corporation to states, cities, counties and other corporations must be loaned on self-liquidating projects. These may include paving; water mains; sewers and treatment works in which costs are to be recovered by assessment; waterworks and sewers where rental is charged to cover interest and sinking funds; toll bridges; and incinerators, where direct charge is made for garbage service.

A requirement in connection with this relief money may be that water works and other utilities must be self-supporting, with full control of income, as is now the case in many cities. Credit arrangements must be made through the Governor of the state, but disbursement and expenditure are under the control of the municipality or county.

This relief bill should open the way to greatly increased and much needed public works construction. Let's go! Public works construction will be one of the most important factors in a return to normal conditions.

Don't Neglect Maintenance

We have been passing through a period in which considerable cuts have been made in highway appropriations. In many places, there has been little, if any, discrimination between cuts in funds for construction and funds for maintenance.

According to the best available information, about two billion dollars' worth of highways were built between 1923 and 1930, and it is reasonable to suppose that these roads are still in existence. The enormous public investment represented by these roads can be very seriously depreciated if highway maintenance is neglected.

About the only tangible thing most of us get out of our taxes is the satisfaction and profit that come from a system of good highways, and it certainly is good governmental, as well as good financial, policy for those in public office to maintain these highways in the best of shape.

Snow in August?

Well, scarcely in these parts. Yet it will not be long before snow actually will fly, and then the engineers responsible for keeping the highways open will find themselves in a very bad way if they have not already planned their campaign, selected their equipment and made ready for the battle. Winter comes, and with it the actualities that now may seem very remote.

New equipment, new ways, new ideas are necessary for prompt, adequate and cheap snow removal. Now is the time to write in for catalogs and information from the manufacturers and to look over the snow removal articles which already are being set up in type downstairs for the benefit of our readers.

And we do hope that unemployment relief will not be used as an excuse for going back to the good old days of shoveling by hand. What was the cost per mile in those days? Check that against modern-day costs and be ready with your arguments if the matter comes up.

Disease Prevention No Place for Economizing

This is a day of change, with new methods necessary and inevitable in most fields of work. Yet typhoid fever, and the other diseases due to improper disposal of human wastes, are spread in the same old way. Garbage dumps produce flies and rats and create nuisance in the same old way. Carelessly produced milk causes disease in the same old way. It is no time for government to cut down on these important items of health protection. In fact, it is more important than ever to prevent disease, since so few of us have the surplus to carry on over the six weeks that a typhoid case, for instance, may persist.

A safe water supply, proper disposal of sewage and other waste and careful safeguarding of the milk supply are necessities. Money spent on these facilities protect human life and have a definite money value to the community.

Relief Work for Engineers

Various relief work projects suitable for engineers and other "white-collar" men are found in use by the "President's Organization on Unemployment Relief," and a list of them may offer suggestions to cities who wish to provide such work. Such a list, prepared in March, is as follows:

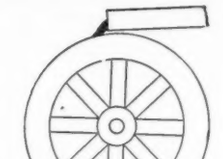
(*a*) *Special projects.*—Traffic count; study of traffic accidents in the county; topographical surveys; surveys of parks, docks, markets, tenements, water supply, and sanitary districts; tree surgery; restoration of old fort; compiling city directory where no funds heretofore available; checking on public school attendance; checking and bringing up to date post maps; entertaining in city hospitals and asylums; office workroom where work from nonprofit-making institutions is done free of charge; police duty for four hours each day at street crossings near schools; making maps of city showing work completed and work to be done; canvassing from house to house to locate jobs; giving out supplies from central warehouse (storeroom); bringing city records up to date; men owning cars were employed for chauffeur service, taking patients to hospitals, and delivering agencies' grocery orders to those in need; revarnishing and cleaning desks in city offices; in an epidemic, men were employed to put up signs.

(*b*) *Supervisory work.*—As foremen, inspectors, timekeepers, and paymasters on work on parks and buildings and around municipal buildings. Work on bridge building and repair. Supervising cleaning up of yards.

(*c*) *Additions to the force in relief agencies and welfare offices.*—Supplementing the existing staff as clerks, interviewers, investigators, stenographers, file clerks, and statistical clerks. Making work-relief plans as engineers, architects, and draftsmen, tabulating data on relief work being performed. Office workers lent to private organizations. Recreational leaders for boys' clubs and social centers.

(*d*) *In nonprofit-making institutions.*—As nurses, orderlies, and guides in hospitals; clerical help in institutions; cataloguing, renovating, and arranging exhibits in libraries, universities, and museums; planning and overseeing repair work, as engineers; plan examining and specification writing in municipal building department, department of education and department of hospitals, as engineers, architects, and draftsmen.

THE WATER WHEEL



By
Jack J. Hinman, Jr.

The essential features of important articles of the month having to do with water works design, construction and operation and water purification, arranged in easy reference form and condensed and interpreted by a leader in the water works field. Published every month to include articles appearing during the preceding month.

TAKEN as a whole, the literature of water supply varies in its emphasis from month to month, reflecting conditions in the industry and the recent difficulties and triumphs of water works men. The literature of the month just past is predominantly literature of the laboratory and of laboratory control of water purification plants. It is true that there are papers on construction, on dams and on pipes, but these are relatively fewer than usual.

Plant descriptions seem to emphasize Canadian installations, such as those at Lachine,[15] Montreal,[6] Ottawa,[96] and Vancouver[53, 109]. Papers on **English plants,** such as those of the Axbridge Rural District,[70] and of Bournemouth,[71] tend to strengthen the impression that English operators are favoring rapid sand filters of the **pressure type** much more strongly than is true of American operators. Plant descriptions of new municipal **water softening** plants at Findlay, Ohio,[25] and Massilon, Ohio,[102] show that in the Middle West the popular desire for softer water is being gratified. Goudey, of California,[54] recently made a pilgrimage to a number of the newer water plants in the Middle West. He reported that filtration plants merely to remove color and turbidity from water are no longer in vogue, but that all new plants invariably provide for softening. Goudey was especially surprised and impressed with the extent and efficiency of the **laboratory control** work carried on by progressive water departments. It seemed remarkable to him that even such eastern plants as the Wanaque supply find it important to maintain close laboratory supervision over the water supplied.

During the last month no fewer than four reviews of the 26th annual report of **Sir Alexander C. Houston** on the laboratory control of the **London** water supplies[n8, 11, 17, 86] have appeared. This report contained material on tests for streptococci in water, on the use of ozone in water treatment and on an epidemic of milk-borne para-typhoid fever at Epping, which necessitated special precautions with the water of a brook on a watershed area contributing to the supply of the metropolis. Many other topics are discussed. The average daily consumption of London in 1931 was 281.3 million British Imperial gallons.

From the standpoint of public health there are several interesting papers this month. Kline and Fuller[7] discuss at more length the public health significance of laboratory findings in water from springs in rural New York in which **salamanders** have been found. This matter, referred to in the Water Wheel for July, becomes important from the great difficulty of keeping salamander larvae out of the springs and from the night feeding habits of the salamanders, which cause them to wander from the spring and eat material containing colon group bacteria. These are then excreted into the spring water. The depth of penetration of the salamanders into crevices in the springs is astonishing. When springs have been dug out, specimens have been found as far back as ten or twelve feet from the point of emergence of the water and at depths as great as six or eight feet from the surface.

A water borne epidemic of **typhoid fever** at Ecclefechan, Scotland[65], famous as the home of Thomas Carlyle, was attributed to the entrance of surface pollution into a pipe carrying spring water to a collecting reservoir.

In discussing the part **fluorine** is believed to play in the **mottling of the tooth enamel** of persons who receive their second set of teeth in certain localities, McKay[110] admits that the connection of fluorine with the condition is not yet conclusively proved although all available evidence indicates that drinking water containing more than two parts per million of fluorine is the probable source of the difficulty. First suggestion of fluorine in this connection is said to have been that of Hannan in 1926.

The influence of excessive amounts of **saline and alkaline substances** in the drinking waters of animals has been under investigation for some time by Heller[66] and his coworkers in Oklahoma. He states that large amounts of salts are definitely deleterious, but that the effect seems to be due to osmotic conditions, rather than to any specific iron effect and that any antagonistic effect of the ions among themselves seems to be lacking or secondary. Animals seem to suffer less than plants from high mineralization of water. Apparently chlorides are less injurious than sulfates and organic salts less than inorganic salts. Alkalies are more injurious than normal salts, probably due to the change in hydrogen ion concentration in connection with the osmotic effect. About 15,000 to 17,000 parts per million seems to be the maximum amount of salt in a water that can be used safely. Experimental animals show interference with lactation and reproduction before the level producing stunted growth or death is reached.

The sanitation of the area used for the **Yorktown sesquicentennial** celebration is discussed by Miller[72, 74]. The little town of Yorktown, Virginia, with a population of 480, had neither water nor sewer facilities to cope with an influx estimated to reach 120,000 persons on one day of the celebration. Chlorinated artesian well water was supplied through specially laid pipes. These pipes were given a heavy chlorine dose before pumping the water through them, but the bacterial counts on specimens taken from the system were not

as low as hoped. Special drinking fountains were installed in several places on the grounds. Latrines with septic tanks or of the earth pit type were constructed for most of the area. A portion of the field was upon the watershed of a nearby city water supply, however, and on that area privies of the hopper type were built and the excreta was taken off of the watershed for burial.

The city of New York is in the habit of treating **newly laid mains** and those contaminated by repair work, with from one to five parts per million of free chlorine, according to W. W. Brush[125]. Usually the dose is about three parts per million, since larger doses seem to combine with material of the pipe coating to give prolonged taste troubles.

Probably the most important publication of the month on piping is a bulletin by W. J. Schlick[35] on **loads on pipe in wide ditches.** This bulletin, which carries an April date, refers directly to the estimating of loads on vitrified clay pipe in ditches, but of course similar loads would be carried by any pipe of similar diameter under similar conditions in the trench. The effect of freezing on **lead and copper** pipe has been studied in England by Larard and Oliver[18] who found that copper pipe was more likely to burst on the first or second freezing than was lead pipe. Their findings have been contested by Buckingham[20], who insists that at Manchester the difficulty with copper pipe is less frequent in service than with lead pipe and that lead is more likely to take a permanent deformation under freezing than is copper piping. Isles[67] shows that the **design of cocks** makes a great difference in the frictional resistance to the passage of water. Continuing the sides of the port-opening smoothly through the cock reduced the friction from 25 to 50 per cent. Nelson[32] gives useful advice on the care needed in valve operation, especially in the operation of valves which have been left undisturbed for some time. Goldsmith[57] calls attention to the fact that the value of **exact location information** concerning valves and even pipe lines, and the value of the **regular inspection of the valves** of a water works distribution system are yet not as generally appreciated as they should be.

One of the most interesting of recent distribution systems stunts was the **tapping of a concrete conduit** at Detroit[21] while in service. The work was conducted by utilizing the principle of the diving bell and under an air pressure of seven pounds. A huge **derrick boat** has been constructed to handle 100-foot lengths of the eight-foot concrete and steel pipe of the new Toronto water works intake[16]. These pipe sections will weigh about 250 tons each. The installation of the 34" **Bonna pipe** in the high-service distribution system of the Montreal water works has attracted English attention[92]. Interest in **pipe welding** in Germany[30] is producing a number of papers on the subject. A dispute over pipe-welding patents[27] may delay completion of a pipe contract involving nearly $10,000,000 for the Hoover Dam project.

McGrew[100] writes interestingly of **wells** and the part that they play and have played in our water supplies. Modern **sanitary specifications for water wells,** together with the public health reason for each requirement are given by Klassen and Ferguson[60] in an article which should be studied by every well driller and by every water works superintendent whose water supply comes from underground sources. A knowledge of the importance of the matters described in this article should be required wherever, as in Wisconsin[34], a well drillers license law is proposed for raising the standards of the well drillers and improving the type of work done. The **drawdown of wells**[36] may conveniently be measured with considerable accuracy by lowering an airtight pipe open at the bottom, until the tip is below the point to which the water is lowered. A gage for measuring the pressure in feet or pounds is then attached and air pumped into the tube until no further pressure rise is indicated, showing that air is escaping into the well. The pressure shows the height of the balanced column of water outside of the air pressure pipe and hence the height of the water in respect to the bottom of the air pipe. The height of the water in the well at rest may be determined similarly when the level has been re-established and the drawdown is then determined by the difference of the two levels.

Tonney and Noble[64] discuss the relative importance of the **Bacterium coli and the Bacterium aerogenes in well waters.** They insist that the latter type of organism is of less significance in well waters than the former type, as far as the indication of direct fecal pollution is concerned. They admit that the organisms of the Bacterium aerogenes type indicate potential danger. Such condition of course calls for immediate investigation and rectification of defects.

As might be expected under present economic conditions, more concern than usual is being shown in the **elimination of waste,** whether it be in the reduction of **waste of soap** or in the lowering of **water losses from distribution systems.** Hudson and Buswell[26, 58] have studied the actual economic loss due to the waste of **soap** in cities with hard water supplies. Taking Superior, Wisconsin, a city whose water supply has a hardness of 45 parts per million, as a basis, they find that the waste in Bloomington, Illinois, (hardness 70 ppm.) is 60 cents per capita per year. In Champaign-Urbana, Illinois, (hardness 298 ppm.) the waste is $1.98 per capita per year, while in Chicago Heights, Illinois, (hardness 555 ppm.) which has the hardest city water in the state, the waste is $3.67 per capita per year. The importance of **underground leakage** in a great city like New York, is explained by Nelson[126]. During the past twelve years, investigation of complaints has resulted each year in saving from 7½ to 18½ million gallons per day. This saving in 1931 amounted to 14 million gallons per day while a special survey crew was able to save an additional 26 million gallons per day by locating and stopping underground losses. In smaller cities, such as Erie, Pennsylvania,[97] and Norwood, Massachusetts, [103] surveys to detect leakage have also been profitable. It is generally appreciated that it pays to attempt to locate and stop underground leaks[114]. A paper by Professor F. C. Lea[85,91] before the Institution of Water Engineers, of Great Britain, on the subject of **ancient and modern methods of measuring water,** remind us that Frontinus, when superintendent of water works in ancient Rome, also had his troubles with underground losses of water of the intentional, as well as the unintentional variety.

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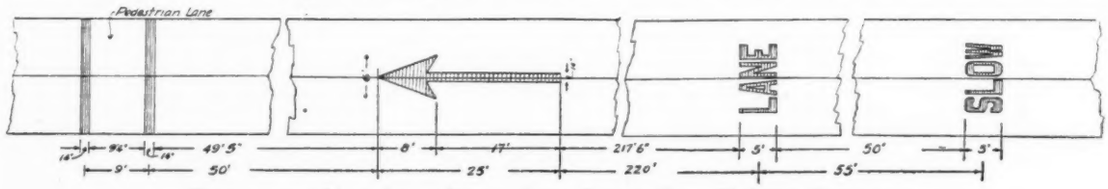
5. Water Meters—Are They a Benefit? E. H. Ruehl, p. 57.

(Continued on page 41)



Pavement markings for pedestrian lane; Oregon State Highway Department

How Shall We Mark Traffic Lanes?

HAVING been caught in a typical West Coast (California) fog at night, the writer had very forcibly impressed upon him the poor visibility of the traffic markers in use. On the "black top" pavements and some of the concrete pavements a metal marker is being used that has very low visibility, especially in a fog and at night. It was with some relief that he finally reached a concrete pavement having the longitudinal points poured with asphalt which showed to advantage.

This unpleasant experience determined the writer to try to find out "what the other fellow was doing and how much it was costing him to do it," which inquiry was directed to highway departments and cities on the East, Gulf and West Coasts as well as to several inland cities. The information obtained is condensed in the following paragraphs:

Louisville, Ky., uses white lines painted on the pavement within 120 feet of the intersection, which is easily seen under any weather conditions. In the central part of the city three lanes are marked out, with a brown arrow in each at the corner, curving to the right in the right hand lane, to the left in the left hand lane, and straight (for through traffic) in the center lane. Red and white lines painted on the curb signify no parking, and black and yellow lines on the curb signify temporary parking for business only.

Burton W. Marsh, traffic engineer, Philadelphia, Pa., has this to say:

"We are all striving to find a satisfactory, inexpensive and reasonably permanent pavement marker. I do not believe that anyone has as yet found it. In a city where there are numerous lights, one usually gets some reflection from metal markers at night. There is no doubt, however, that they lose a good bit of their effectiveness at night—and if only the drivers' headlights are depended upon, they are of very little value.

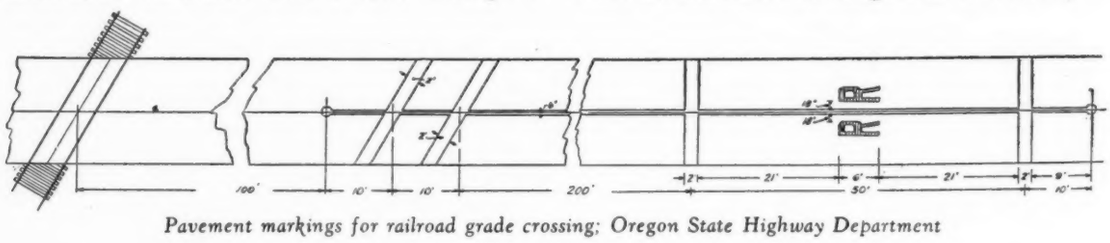
"We have been doing some experimenting with a white rubber button of the same general mushroom design that is so familiar with metal markers. We have found that this type is not suitable for granite block pavements where there is heavy traffic. It has the merit of the white color of the rubber, which gives a definite color contrast. We have been conducting some tests of the efficiency of different traffic marking paints but these are not yet completed."

New York State Division of Highways informs that they have used various types of devices. Of the hand machines, which they use in isolated cases where little marking is to be done, the one found most satisfactory is made by Littleford Bros., Cincinnati, Ohio. Of the larger type machines, they used one made by the DeVilbiss Co., consisting of a compressor, paint tank and a double-wheeled small trailer with a double disk mounted between the wheels. This equipment is mounted on a 1½-ton truck and has performed satisfactorily. Upon the strength of the experimental performance of this equipment ten machines were purchased. Cost data were not given, due to variations in the different parts of the State. White paint is used exclusively, being more visible than any other color on both asphalt and concrete under all conditions.

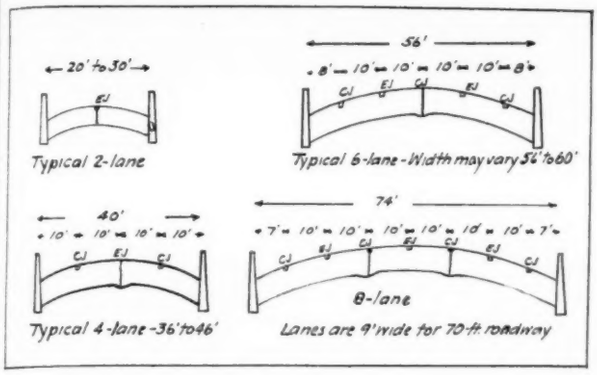
Portland, Oregon, uses orange lacquer, but, due to its slipperiness in wet weather, the traffic department is recommending the use of metal markers this year, believing them to be fully as visible and last several times as long.

The Oregon State Highway Commission has used white paint on both black and concrete pavements for center lines. It uses yellow paint and lacquer for railroad and pedestrian crossings. Their traffic engineer seems inclined to the use of lacquer as it has the advantage of long life and quick drying; however, it has the disadvantage of slipperiness in wet weather. Last year's marking cost ran between $20 and $25 per mile of 4-inch strip, but with contemplated improvements in methods, this year's costs are expected to run between $15 and $20 per mile. Some metal markers have been used, but are expensive for highways, and in black-top pavements they are apt to be covered by creeping of the asphalt in warm weather.

New Orleans, La., uses "Womblu" yellow cotton striping 7 inches wide at a cost of $80 per thousand lineal feet. This striping has been used in very heavy traffic around school buildings and its visibility is ex-



Pavement markings for railroad grade crossing; Oregon State Highway Department



Longitudinal expansion and contraction joints used as traffic markers.

cellent. They have only one street using traffic markers of metal; experience too limited for comment. Painted stripes were unsuccessful due to inconvenience of closed streets while the paint hardened sufficiently to withstand traffic.

Richmond, Va., uses traffic paint, getting good results and visibility. Cost $18.32 per intersection per year for both labor and material.

California Division of Highways uses traffic lacquer in general. It has a considerable mileage of asphaltic stripe placed on the newer concrete surfaces, but when the concrete surface becomes blackened to such an extent as to mar the visibility of the asphaltic stripe (usually good for 3 years at a cost of $15 to $20 per mile), the asphaltic stripe is painted over with white traffic lacquer, which gives good visibility at night and in fog. The cost of placing the lacquer stripe is about $40 per mile of 4-inch stripe, which usually must be renewed once each year, and in cases of heavy traffic, sometimes twice or more. The replacement cost of the stripe is the same as the original less the cost of marking out the center line, which runs $5 to $7 per mile according to alignment, traffic conditions, etc.

Beverly Hills, Calif., installed two concrete stripes in a black-top pavement on Wilshire Boulevard, their main thoroughfare into Los Angeles and the Beaches, but it has the effect of dividing the street into three lanes and the disadvantage of not dividing the center at all. These lines have good visibility.

In painting a 6-inch stripe on 12.4 miles of boulevard from Beverly Hills to the ocean, 303½ gal. of white paint were used and required seven days' time of three painters, using a machine furnished free by the paint company. Both Zone-lac and Traffik-lak were found satisfactory. The cost averaged $67.25 per mile, of which $52.65 was cost of paint and $14.60 was labor. It was estimated that a 4-inch stripe would cost $49.60.

Los Angeles, Calif, is experimenting with various devices, among them metal markers, painted stripes, Atlas white cement lines and buttons in intersections of Atlas white and dolomite concrete. The paint must be renewed every three months. The metal markers, due to their oval shape, give poor visibility and are not satisfactory*, in the opinion of the writer, as they will sink and, due to creep of black top, become buried; while on hard concrete they become loose very easily and remain to rattle or are entirely lost; in some cases they have broken from the dowel, which remains to tear casings of passing cars that happen

*Many of these objections have been overcome by recent developments in manufacture and material.—Ed.

to cross from one traffic lane to another. On a number of the late concrete jobs longitudinal joints, 3/8 inch wide, have been constructed in position to act as traffic lanes, and have a strip, 4 inches wide, one each side, troweled smooth, which gives a contrast to the remainder of the roughened surface and good visibility, even at night and some fog.

Mr. John Beakey, traffic engineer, Oregon State Highway Commission, communicated with all state highway departments and found few which had specifications and these were very broad. It is the opinion of the writer that further investigation into this subject could very profitably be made by all concerned, for apparently the subject has not been thoroughly looked into and as yet is in the experimental stage with those who have made any attempt to work out a solution.

How Indiana Removes Snow and Ice From Highways

Indiana's snow fighting forces, when keeping roads free from snow during a storm or opening them after a storm, find their greatest handicap to be the stalled motor vehicles which had persisted in attempting to proceed when the road was blocked. Stalled automobiles, trucks and buses have to be removed before the snow plows can go through. The department hopes next winter to install a better warning system with police regulations during severe storms to stop traffic when and where stalling is probable.

One important change in practice is not to send out snow fighting forces and equipment during severe storms. At such times, when light snow is blown by a gale, no outfit can prevent the road from becoming blocked. Usually such storms last but a day or two and much better results are secured by laying up the equipment and permitting the forces to rest rather than expend the energy of the men and break more or less of the equipment by operating during such adverse conditions when little good can be accomplished. As soon as the storm subsides the fresh forces and equipment in proper trim can open the road quickly. The combination of proper warning to the public and conservation of personnel and equipment during the most severe stages of a storm has proven the most practical method of combating snow.

The Indiana Highway Commission owns for snow removal purposes 96 blade plows, 112 V plows and 2 rotary trucks. It contemplates purchasing 28 heavy trucks suitable for this work in addition to a number of Liberty trucks that are being equipped with pneumatic tires for this work, since most of its old trucks are very unsatisfactory for heavy snow removal work. Some heavy trucks have been purchased the past two years because of the necessity for having them available for snow removal work. While they are used very satisfactorily in doing hauling and other miscellaneous work, this other work could frequently be done as satisfactorily with lighter trucks. The main requisite in keeping the roads open and free from snow in the snow belt area is in being properly equipped with sufficient heavy snow fighting machinery to take care of the emergencies. With the new equipment purchased and other equipment contemplated in the form of heavy trucks, the highway commission will be in a better position to combat the heavy storms than ever before.

A high grade line and a wide right of way will reduce very materially the cost of snow removal work and make it much easier to keep the roads open during a severe storm. A wider right of way forces fences and other structures which may cause snow to drift, farther from the traveled way. Also it makes possible a higher grade line, which reduces the drifting on the traveled way, and makes it easier to remove the snow by providing more space to deposit the snow just outside the traveled area.

Some states are now attempting to control the snow drifting on the highways by the use of wide rights of way and the planting of a permanent hedge or line of trees at the edge of the wide right of way, the growth to serve as snow fence and collect the snow before it reaches the pavement. Where main roads pass through country which has a low land value it would seem that this method is a very economical one to pursue. It is only at certain locations where the snow drifts badly that such wide rights of way and snow fence need be provided. Through built-up territory and rough country, and particularly in wooded areas, the drifting of snow ordinarily is not such a serious problem, as there are so many obstructions to retard the speed of the wind, allowing the snow to lodge before it reaches the highway.

Treatment of Icy Surfaces

The treatment of slippery roads coated with ice is becoming a greater necessity each season because of the high speed traffic and the demand that all state highways be open every day of the year. The practice is being developed of coating the icy spots on the important roads with cinders, sand, fine crushed rock or other aggregrate which will produce a gritty- nonskid surface. The use of a mixture of granular calcium chloride with cinders or other aggregate in the proportion of about one hundred pounds to two cubic yards of the grit has been found to be very effective in eliminating the slippery condition. The calcium chloride slightly thaws the ice so that the cinders or aggregate becomes anchored to the surface. With the use of calcium chloride the effect takes place within a few minutes, whereas during a cold and windy day without the use of calcium chloride the cinders or grit may be blown from the surface and thus be of no service to traffic.

Convertible Shovels for Municipal Work

By C. E. Kohl
Crane and Shovel Engineer, Austin Manufacturing Co.

IN many municipalities, from the largest cities to the small towns, street, sewer, water and other departments are finding the newer types of tractor shovel to be savers of both time and money, in trenching, road work and handling aggregates and other materials, loading snow and a wide variety of uses.

The standard equipment is the dipper boom and dipper for shovel work. But this can be replaced with a crane boom and clam shell; or with a telescopic crane boom and sheave hook block; or with a drag-line attachment; or with a trench hoe. Only about an hour is required for changing one of these booms for another.

The clam shell is useful for unloading materials

from car to stock pile, or stock pile to truck. A telescopic boom with a 10-foot extension to a 25-foot boom, on a three-eighths yard shovel, can handle approximately 3,000 pounds at a radius of 15 feet. The drag line is useful for trimming up stock piles or grading land, building dikes, etc. A trench hoe can be used for digging trenches up to 14 feet depth, and for digging and cleaning ditches up to 20 feet wide on top. For digging wide ditches, as for large sewers, the drag line has been used successfully. Examples of all these uses have been referred to in PUBLIC WORKS in articles describing various construction activities.

While the extension of the field of work for the convertible shovel is due in a large measure to the attachments which manufacturers have provided, it has been aided by many mechanical improvements in the mechanism. The shovel of today is much more reliable than formerly, has greater flexibility and portability, and the maintenance and operating costs are much lower. This latter point is partially due to the fact that heavy anti-friction bearings are used at every moving point of consequence. The reduction in friction losses on shovel equipment has brought about a very definite reduction in the size of the power plant required to perform the same operations.

Other mechanical refinements include booster-type clutches, brakes which are readily renewable, high-pressure lubrication of all points, and a greater degree of accessibility. Shovels are now designed so that all of the clutches are interchangeable and of a more or less standard tractor design so that repair parts are obtainable anywhere without difficulty. Cut gearing, enclosed and running in oil, is another design feature now utilized in small shovels.

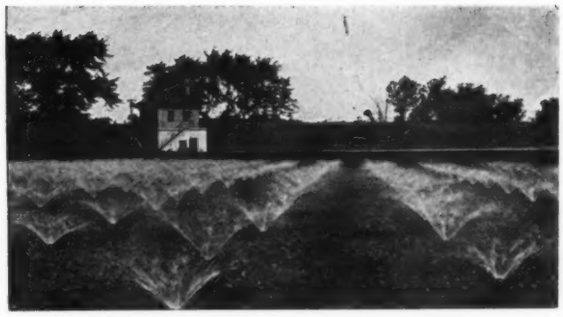
Another point which has been given considerable attention has had to do with increased portability. Tractor speeds as high as four miles an hour on the road are now obtainable, although it is ordinary practice not to depend on the machine's crawlers to transport it any distance, but to provide a mounting of rubber-tired wheels for quick transportation and tow behind a truck. With such a mounting it is possible to transport a shovel at a speed of 25 miles an hour from job to job. By utilizing the power of the crawlers and with suitable blocks it is possible to mount the shovel on its wheels in approximately ten minutes and to demount it in five minutes.

Resurfacing Highways With Brick

The design features of brick resurfacing projects constructed on Illinois highways last year have been modified for the work this season. Although the total width of pavement from out to out of curbs will be 20 feet, a uniform 12-inch concrete curb will be used on all projects. This means, of course, that the brick surface will have a uniform width of 18 feet. The widening, in cases where the existing concrete slab is less than 18 feet, will consist of extensions of the concrete base with integral curbs. There will be a projection of the widening concrete under the old slab. but the bottom will be sloped to meet the designed depth at the edge. As was the case last year, bituminous mastic bed or cushion course has been specified.

The Indiana Highway Commission also will utilize brick for resurfacing concrete and will specify a concrete curb 12 inches wide and 10 inches deep, but with no projection under the edges of the old slab.

Sanitary Engineering



Costs of Laying Water Mains, 1925-1932

THE following costs have been reported to us by the engineers and superintendents of water works throughout the country. Unless otherwise indicated, costs are for cast-iron pipe, and include the cost per lineal foot of the pipe, excavation, backfill, etc., but not the cost of valves and hydrants. Figures were asked for 8-inch mains, and for other sizes only where these were not available.

Cost per Foot of 8-inch Water Mains

City	1932	1931	1929	1925
Anaheim, Calif.	.70	....	....	....
Burlingame, Calif.	....	....	1.37	....
Alhambra, Calif.	2.63	....	2.19	2.22
Los Angeles, Calif.	1.89	1.85	1.81	....
Modesto, Calif.	1.90	2.00	2.00	....
Bridgeport, Conn.	1.75	1.70	1.82	2.33
Hartford, Conn.	....	2.11	2.34	3.07
Southington, Conn.	....	1.67	1.77	....
Orlando, Fla.	....	1.55a	1.55a	1.80a
Hawkinsville, Ga.	1.00	....	....	....
Thomasville, Ga.	1.16	....	....	....
Twin Falls, Ida.	1.10	1.55	1.65	1.75
Columbia City, Ind.	....	2.15	....	....
Delphi, Ind.	....	1.50	....	....
Mishawaka, Ind.	....	1.45	1.65	1.95
Burlington, Ia.	....	2.07	2.10	2.06
Lawrence, Kans.	....	2.18	....	....
Covington, Ky.	....	1.87	....	....
Louisville, Ky.	1.48	1.54	1.66	1.92
Cumberland, Md.	....	1.65	2.42	2.60
Hagerstown, Md.	....	1.80	2.10	2.20
WSSD, Hyattsville, Md.	2.27vh	2.57vh	2.61vh	....
Salisbury, Md.	.78	1.00	1.00	1.22
Belmont, Mass.	2.00	2.00	....	....
Franklin, Mass.	1.50	1.65	1.80	2.00
Haverhill, Mass.	....	....	2.39v	3.20v
Mansfield, Mass.	1.20	1.33	....	....
Revere, Mass.	....	2.00	2.25	....
Wakefield, Mass.	2.00	2.00	....	....
Walpole, Mass.	1.59	....	....	....
Dearborn, Mich.	....	1.35	1.45	1.65
Battle Creek, Mich.	....	1.70	1.90	1.80
Ironwood, Mich.	3.00w	2.25	....	....
Stillwater, Minn.	....	....	....	2.20
Winona, Minn.	....	1.95	2.56	2.87
Canton, Miss.	....	....	1.12	1.41
Jackson, Miss.	1.00	....	....	1.00
Camden, N. J.	....	3.10	3.55	3.80
Ridgewood, N. J.	....	1.48v	1.70v	2.51v
Roswell, N. M.	1.25	1.27	....	....
Fairport, N. Y.	1.60	....	....	....
Fulton, N. Y.	....	1.45	....	....
Saugerties, N. Y.	....	1.75	....	....
Schenectady, N. Y.	....	2.50	....	2.36
Charlotte, N. C.	....	....	1.25	1.50
Henderson, N. C.	....	1.20	....	....
Rocky Mount, N. C.	.92	1.03	1.05	....
Enderlin, N. D.	....	1.40	....	....
Medina, O.	....	1.78	2.10	2.20
Orrville, O.	....	1.68	....	....
Altoona, Pa.	....	2.80	3.72	3.85
Bedford, Pa.	1.10	....	....	....
McDonald, Pa.	1.50	1.50	2.00	2.00
Palmerton, Pa.	....	....	3.60	....
Huron, S. D.	....	1.20	1.26	....
Knoxville, Tenn.	1.15	1.21	....	....
Murfreesboro, Tenn.	....	1.50	....	1.20
Aberdeen, Wash.	1.39	1.36	1.52	....
Port Townsend, Wash.	.98	....	....	....
Olympia, Wash.	....	1.40	....	....
Tacoma, Wash.	....	1.36	1.40	1.76
Wenatchee, Wash.	....	2.15	2.45	2.60
Janesville, Wisc.	1.65l	1.50	....	....
Milwaukee, Wisc.	....	1.55	1.82	2.37
Racine, Wisc.	....	2.57l	1.54	1.97
Stevens Point, Wisc.	1.40	1.45	1.50	....
Wausau, Wisc.	....	1.90	....	....
Wisconsin Rapids, Wisc.	....	....	2.25	....

Cost per Foot of 6-inch Water Mains

City	1932	1931	1929	1925
Alhambra, Calif.	....	1.75	....	....
Manteca, Calif.	....	.84	.97	....
Lakeland, Fla.	....	....	....	1.10
Lincoln, Ill.	....	1.95	....	....
Quincy, Ill.	....	.99v	1.20v	1.46v
Waukegan, Ill.	....	1.45	1.40	1.75
Fairmount, Ind.	....	1.03	....	....
Booneville, Ind.	....	1.10	1.30	1.20
Cedar Rapids, Ia.	....	1.31	1.50	1.52
Mason City, Ia.	1.25	1.23	1.16	....
Augusta, Me.	1.90	2.23	2.25	2.50
Biddeford, Me.	....	1.33	1.68	2.28
Abington, Mass.	1.60	1.80	2.00	2.00
Marlborough, Mass.	....	2.00h	2.63h	2.75h
North Andover, Mass.	....	2.25	....	....
Walpole, Mass.	....	1.65	1.40	....
Kalamazoo, Mich.	....	1.36	1.21	1.70
South Haven, Mich.	....	1.85	....	....
Traverse City, Mich.	....	1.05	....	....
Rochester, Minn.	1.34	1.39	1.39	1.43
Marshall, Mo.	....	1.31	2.50p	....
Miles City, Mont.	1.30	1.45	1.55	....
Missoula, Mont.	....	1.75	....	....
Reno, Nev.	1.60	1.60	1.60	1.60
Dansville, N. Y.	....	1.60	....	1.95
Oneonta, N. Y.	1.38	1.23	....	....
Montpelier, O.	....	1.35	....	....
Springfield, O.	1.36	1.45	1.54	1.60
Ashland, Pa.	....	2.50	....	....
Ellwood City, Pa.	....	1.75	....	....
Hamburg, Pa.	....	1.64	1.65	....
Jersey Shore, Pa.	....	1.42	....	....
Palmerton, Pa.	....	3.00hl	2.50	....
San Antonio, Tex.	....	1.27	1.67	....
Antigo, Wisc.	....	1.38	1.41	....
Kaukauna, Wisc.	....	1.32	1.50	....

a—Laid in 18 inches of sand. *h*—Includes hydrants. *l*—Work done by hand labor. *v*—Includes valves. *w*—Winter construction.

Averaging all the figures given for each year, we have $2.17 for 1925, $1.96 for 1929, $1.74 for 1931, and $1.48 for 1932. This shows the 1929 figures 90% those for 1925; the 1931 figures 80%; and the 1932, 68%. If we average the figures for 1925, 1929 and 1931 of only those cities that report for all three years, we have $2.27, $2.01 and $1.80; the two latter being 89% and 79%, respectively.

In the case of the 6-inch pipe, the averages of all figures are $1.77 for 1925, $1.64 for 1929, $1.56 for 1931 and $1.46 for 1932; and the percentages of the 1925 figures are 92.5% in 1929, 88% in 1931 and 82½% in 1932. These would indicate that the cost of 6-inch mains have decreased much less than of 8-inch, and that the 1932 costs of 6-inch average only 2 cents less than of 8-inch. If we average the figures from only those cities which report for all four years, we find declines to 96% in 1929 to 92% in 1931 and to 85% in 1932; even less decreases from 1925 than were shown by the less accurate inclusion of all figures.

Only a few cities reported figures for 4-inch mains rather than 8-inch or 6-inch, and these showed a drop from an average of $1.44 in 1925 to $1.02 in 1932—a total decrease of about 29%, as compared to 32% for 8-inch and 17½% for 6-inch.

In presenting these costs, it is not intended to give any relation between the costs of doing the work in the various cities. In some instances, the work has been done in paved streets—often in busy down-town sections, while elsewhere the line may have been laid in unpaved streets or in open country. Also, in the south, lines are laid nearer the surface of the ground, and excavation and backfill costs are therefore less. Likewise, freight rates influence the cost of the pipe. The sole aim has been to give the relative costs during the years shown, assuming that these conditions remain uniform in any one city during that period.

Refuse Collection and Disposal by Virginia Cities

L. J. HOUSTON, JR., city manager of Fredericksburg, Va., in 1930 made an inspection trip to a number of cities, both large and small, for the purpose of studying their methods of collecting, handling and disposing of garbage and rubbish, preparatory to adopting an improved plan for his city. (This plan was described in our June issue.) The methods he found employed he described in a paper before the League of Virginia Municipalities, saying: "I was somewhat surprised to find that the best methods were generally to be found in the smaller cities rather than in the larger ones.

"In reviewing the conditions in Virginia as regards the collection and disposal of garbage and trash, I find that the methods in vogue in the several cities and towns vary greatly. For instance, out of 72 cities and towns reporting, 36 of them tender service to 100% of their population, 25 render this service to only a part, and 11 render no service at all. Of the 61 municipalities rendering service, 47 collect garbage, ashes and trash; 9 collect garbage and trash; 4 collect ashes and trash; and one collects garbage only. Six collect daily, 12 collect three times per week, 16 twice a week, 11 once a week, 4 once a month, 2 quarterly, one twice a year, and 9 once a year.

"Fifty-one of these municipalities perform this service as a municipal undertaking, 4 of them do it by contract, and 6 leave it to be performed by their citizens privately. In 16 of the municipalities, trucks of greater than two tons capacity are used, 29 use trucks of two tons or less capacity, and 16 use carts or wagons. In only two were trailers used.

"Collections from the curb or alley were made in 41, from the back door in 10, while 10 did not state the location. In 8 of the municipalities the garbage

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was fed to hogs with the balance going to the dump, 13 used incinerators, 2 buried the garbage, and 38 placed all on the dump, some burning. Eighteen required separation and 43 did not. Only one place reported receiving any revenue from its garbage, which was used for hog feeding.

"As might be expected, the costs of rendering service in the several municipalities also varied greatly, ranging from practically no cost at all to $1.64 per capita per year, depending on the completeness of the service rendered."

Deceptive Fire Hydrants

It was reported a few years ago, during a real estate boom on Long Island, that in one development the beautiful red fire hydrants were only sales persuaders—there were no water mains in the streets. There are some cities where some of the hydrants are almost as useless as this (although no deception is intended) because they are fed by mains that are too small, either originally or because of deposits or tuberculation.

Such a condition, to which attention had been called by the National Board of Fire Underwriters, was corrected last year by Charleston, S. C., by replacing 858 ft. of 6-inch main by 12-inch, and 1268 ft. of 4-inch by 8-inch. In the former case four hydrants gave a total flow of 2060 gals. with a pressure fall from 45 lbs. to 9 lbs.; but on January 28, 1932, after laying the larger main, the same hydrants discharged a total of 3320 gals. with a pressure fall from 50 lbs. to 43 lbs.; and the water available with pressure lowered to 20 lbs. was 1700 gals. before enlargement and 6800 gals. after enlargement.

In the other case the increase was much more pronounced. On April 7, 1931, two hydrants gave a total flow of 335 gals. with residual pressure practically zero; while on Jan. 28, 1932, after laying the larger pipe, they gave 1920 gals., with a pressure fall from 48 lbs. to 35 lbs., and at 20 lbs. residual pressure 2700 gals. was available.

It was proposed to remedy another case this year by replacing 700 ft. of 6-inch pipe with 12-inch.

Sewage Treatment on Pay-As-You-Go Plan

A number of municipalities in Ohio are facing the problem of how to make their existing sewage treatment plants serve for a number of years in the future without expensive outlay for new structures and new equipment. Many of these plants were installed 20 years ago or more, when the necessity of careful operation of the plants was not realized by municipal officials. As a result, even careful operation at the present time cannot overcome the results of neglect during previous years and cannot make a plant deliver a satisfactory effluent at all seasons of the year.

Although most of these plants would now be considered out-of-date in view of the progress made in the science of sewage treatment, still the plants were up-to-date when installed and many of the features of such plants can be made to function as satisfactorily today as when originally constructed. Other features of these plants can, with minor changes or additions, be changed so that the plant will conform to up-to-date practice.

Two Ohio municipalities, faced with this problem, have recently adopted a general plan for improvement

of their existing plants. This general plan does not contemplate a bond issue for improvements but the work is laid out so that a portion can be done each year with the money available annually. If this scheme is adhered to, the municipality will have a modern plant within a few years without the expenditure of a large amount of money. Each of these two municipalities has the "sewer rental" plan of financing sewerage and sewage treatment so that a small sum is available each year.

This plan has the additional advantage, at present, of getting the work done very cheaply and of providing labor for the unemployed, which is the problem of greatest moment with officials of every municipality in the state. The improved effluent delivered by a reconditioned plant may also avert the filing of damage suits against the municipality due to stream pollution, now being caused by the existing plant.

For the foregoing reasons municipal officials would do well to give consideration to improvements of their existing sewage treatment plants at this time. It is most essential, however, that a definite engineering plan, accompanied by a definite plan of financing, be worked out for the improvements, so that the work done each year will eventually result in conversion of the old plant into a modern plant, with every part coordinated to the local need.—*Ohio Health News.*

Notes From Water Works Departments

Two *diesel engines* are being installed in the water pumping plant at Van Buren, Ark. Madera, Ark., is investigating diesel engines for operating turbine pumps.

Beaver, Pa., has a diesel engine which runs on gas. This is a 6-cylinder, 240-hp. Chicago Pneumatic Tool Co. engine which, due to the low cost of gas, has been fitted with low compression heads, which can be changed for oil whenever desired. The pump is a 2 m.g.d. Aldrich triplex. The entire unit was installed in 1928, and A. G. Dallenbach, superintendent, says nothing has been spent for repairs on the pump since that time, and practically nothing on the engine, though it has run 7,829 hours. With gas costing 45c per thousand cubic feet, the cost has been $9.90 per million gallons raised 384 feet.

An *electrically* driven centrifugal pump of 2 m.g.d. will be installed by the San Jose, Calif., water works.

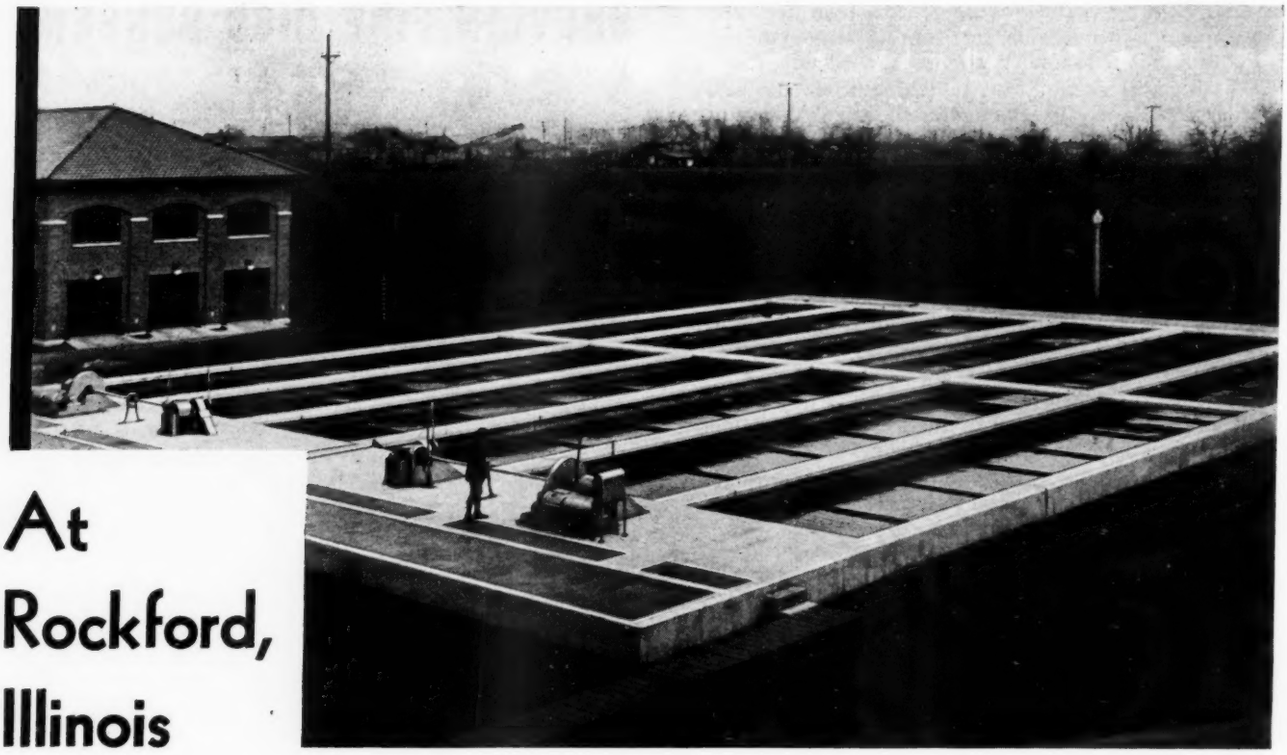
Elgin, Ill., plans complete electrification of its main pumping station, including three deep-well turbines of 1 m.g.d. each, two centrifugal booster pumps of 4 m.g.d. each, and one of 2 m.g.d.

Eleven electrically driven centrifugal pumps will be installed in a new pumping station which is being built by the Racine, Wis., water department at a cost of $438,000.

Two electrically driven centrifugal pumps, each of 300,000 gallons capacity, are among the 1932 plans of Oneonta, N. Y.

Schenectady, N. Y., operates three Worthington electrically driven pumps, and Emmett Blessing, superintendent of water, reports that, based on the actual cost of operating the pumping plant, it cost $16.64 per million gallons of water raised 290 feet.

Labor unemployment at Wauwatosa, Wis., was relieved by laying 8,900 ft. of 12-inch pipe, all by hand digging. The cost per foot, including two hydrants and fifteen 12-inch gates, was $2.83. Centrifugal and monocast pipe was laid.



At Rockford, Illinois

STRAIGHTLINE Collectors and Bar Screen

(Pearse, Greeley & Hansen, Engineers)

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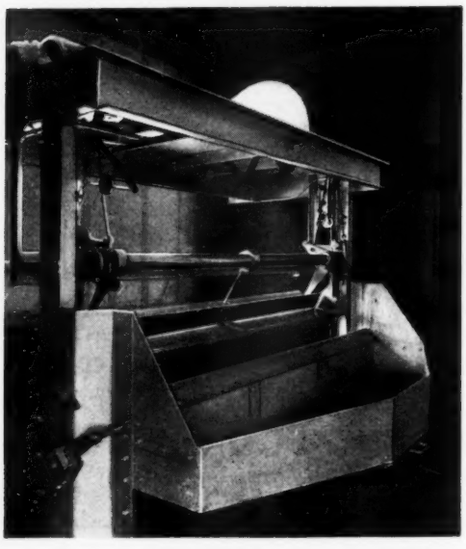

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The Water Wheel

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45. Graphic Calculations in Water Analysis, John Kenneth Sellers, pp. 297-298.

46. Ashing Apparatus for Samples Containing Traces of Iodine, George M. Karns, pp. 299-300.

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57. Distribution System Facts and Fancies, Clarence Goldsmith, pp. 854-858.

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87. The Goyt Valley Water Supply: Stockport Corporation Waterworks, Anon., pp. 295-297.
88. Rainfall, V. Variations in the Rainfall over the British Isles, Anon., pp. 298-301.
89. Current American Water Works Practice. Meters: Future Water Requirements: Pipe Linings: Ammonia Treatment, W. Gordon Carey, pp. 302-303.
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91. Ancient and Modern Methods of Measurement of Water, Discussion of Paper by F. C. Lea, (See reference No. 85) pp. 305-312.
92. Reinforced Concrete Steel Water Mains: Installation of 34" Bonna Pipe for High-Level Distribution System at Montreal, C. J. Desbaillets, pp. 315-316.
93. Advantages of Mechanical Removal of Sludge in Water Softening Plants, Frank Bachman, pp. 318-319.
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98. Aeration, Part 2: Compounds which may be Removed from Water by Aeration, John R. Baylis, pp. 252-254.
99. Cost for Power for Pumping vs. Pump and Motor Efficiency, George B. Massey, pp. 257-258.
100. Wells and the Part they Play in our Water Supply, W. R. McGrew, 259-260.
101. New Type Car for Use in Shipment of Water Works Chemicals, Anon., p. 264.

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103. Unaccounted-for-Water Reduced 45% by Water Survey, C. A. Bingham, p. 740.
104. Problems Arising from After Bacterial Growth in Open Service Reservoirs, Howard A. Johnson, pp. 741-743.
105. How Far Should a Company Go in Making Unprofitable Extensions? H. B. Richards, p. 743.
106. Court Interpretations of Laws Pertaining to Water Works Employees, Leo T. Parker, pp. 744-746.
107. Purification Division's Discussions Considered Valuable Part of A.W.W.A. Convention Proceedings, Anon., pp. 751-753.
108. San Diego Starts Hydraulic Fill and Rock Embankment Dam, Hiram Newton Savage, p. 757.
109. Development and Growth of a Large Canadian Water District, E. A. Cleveland, pp. 762, 765 and 766.

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111. Elements of Water Purification, C. K. Mathews, pp. 793-794.
112. Recent Important Decisions of the Higher Courts as to when Diversion of Water is Legal, Leo T. Parker, pp. 796-798.
113. Water Pressures and Rates in Cuba, Jose Garcia Montes, Jr., p. 798.
114. Locating Leaks that Do Not Show on the Surface, Questionnaire Replies, pp. 709-802.
115. Report of Finance and Accounting Division Sessions Concludes the A. W. W. A. Convention Proceedings, Anon., pp. 803-804.
116. Boiler Feed Water Problems Caused by Acids or Compounds, Helman Rosenthal, pp. 819-820.

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117. Remedying Taste and Odor Complaints Resulting from the Water Supply of Toledo, R. W. Furman, pp. 846-850.
118. Watershed and Rainfall Data Studied in Design of Small Town Water System, C. N. Harrub, pp. 851-852.
119. Actual Investment and Reproduction Cost as a Basis for Fair Return, L. T. Reinecker, p. 852.
120. When the Water Works is Blamed for the Sins of Architect and Plumber, it Shows Need for Cooperation, James E. Gibson, pp. 853-854.
121. Lighting Grounds for Night Repairs, Questionnaire Replies, pp. 855-857.
122. Vibration Troubles (from Pumps), Letter and Questionnaire Replies, p. 858.
123. Policy of Meeting Consumer Half Way a Conciliatory One, Wm. C. Hawley, pp. 865-866.
124. Water Accounts Simplified by Mechanical Billing Plan, John E. Stapleton, pp. 866 and 869.
125. Sterilizing New Mains and those Contaminated by Repair Work, William W. Brush, pp. 869-870.
126. Underground Waste Detection as a Factor in Conservation Program, Fred B. Nelson, pp. 874 and 877.

New York State Hospital Pumps Sewage

Owing to the fact that the State Hospital for the insane located at Rockland, N. Y., is situated on the watershed of the Hackensack river, a source of public water supply, the effluent from the sewage treatment works which are located on the institution grounds is pumped through a cast-iron force main to Sparkill creek, a distance of over four miles. These works consist of Imhoff tanks, glass-covered sludge drying beds, sprinkling filters and final settling tanks. The total cost of the sewage treatment plant and the force main is estimated at $327,000.

The hospital water supply, of excellent physical, chemical and bacterial quality, is obtained from a group of deep wells.

Sewers Without Manholes—An English Suggestion

H. C. H. Shenton, a prominent English sanitary engineer, has suggested that, in these times when economy is necessary, it might be possible to omit manholes from sewers. Said he:

"Anyone who has had much experience of sewers knows that it is quite possible for a long section of sewer to work for an indefinite time without clearing from the manholes. It is true that stoppages may occur and very often do occur when sewers are misused and that manholes in such cases are indispensable, but so small is the amount of cleaning done from the ordinary manhole in the majority of small sewers that many unorthodox persons have suggested that the manholes are unnecessary. It is very certain that if the manholes were omitted on a long length of sewer serving many houses it might work satisfactorily for an indefinite period; also it might not. It has, however, been argued that no stoppage is likely to occur, and that if it did occur, it would be cheaper to open the sewer and deal with the matter in that way than to incur the expense of building a large number of manholes. This is hardly possible, but it would certainly be possible in some cases to effect a considerable saving by laying sewers of small diameter in iron pipes, junctions being provided where necessary for connections, and hatch boxes being provided in place of manholes, leaving manhole construction for a later date.

"It may be asked whether the manhole is not a survival from the time when sewers were not self-cleaning and when they were grossly misused. It is common experience that where sewers or drains are provided in places where the inhabitants are quite unused to such luxuries, the gullies and manholes are frequently looked upon as convenient receptacles for rubbish. Thus, under such circumstances it is no uncommon experience to find that ashes and garden refuse, tin pots, scrubbing brushes and other matters enter the sewers and cause trouble.

"During the war the writer laid 1½ miles of 9-in. cast-iron sewer at a gradient of 1 in 600. The pipes were laid above ground level as a temporary provision for hospitals. Hatch boxes for cleaning were provided at intervals of 300 ft. The sewer was used for four years, during which time no stoppage occurred and no hatch box was opened. It is true that ample flushing facilities existed, but this sewer was an object lesson."

Col. Waring, who introduced the separate system into this country in 1880, built the Memphis sewers, the first system of small sewers in this country, without manholes, but in a few years frequent stoppages necessitated building manholes throughout the system.

Personal and Industrial News Items

The Keystone Driller Company of Beaver Falls, Pa., announces the appointment of G. L. Harman as General Sales Manager. Mr. Harman was, until recently, Sales Manager of the Industrial Brownhoist Corporation, Cleveland. He is a native of Bay City

G. L. Harman

and graduated from the Engineering Department of the University of Michigan in 1906. Simultaneously Lynn H. Ransom has been made Chief Engineer. Mr. Ransom is a native of Beaver Falls, Pennsylvania. In 1925 he received the degree of Mechanical Engineer from Cornell University. He has, since 1926, been connected with the Engineering Department of the Keystone Driller Company. The company also announces the resignation of J. Vale Downie as advertising manager, and the engagement of the Frank Presbrey Co., N. Y., as general advertising agents, with Nils Bowland, vice president, Pittsburgh, Pa., in direct charge.

All of the fire hydrants and valves on the elaborate fire protection and water supply system for Century of Progress Exposition to be held in Chicago in 1933 are to be furnished by The Kennedy Valve Manufacturing Company of Elmira, New York.

It is estimated that about 100 fire hydrants will be required and these are all to be of the Kennedy Safetop design. These are to have a 6-in. bell connection to the mains with 5-ft. depth of trench. Each hydrant is to have a 5¼-in. inlet valve, two 2½-in. hose nozzles, and one steamer nozzle.

An order for 435 six-cylinder trucks, costing more than $1,000,000, to be used by the government for pickup, relay and delivery of the mails, has been awarded The White Company by the United States Postoffice Department, at Washington.

Two hundred and seventy-five of these new trucks will have a gross weight capacity of 13,000 to 14,000 pounds and 160 will have a gross weight capacity of 22,000 pounds.

J. Summie Whitener, Associate Professor of Sanitary Engineering, North Carolina State College, Raleigh, N. C., is to join forces, during the summer, of the Industrial Chemical Sales Company, Inc., New York City, manufacturers of Aqua Nuchar, in demonstration work for North Carolina, South Carolina, and Tenn. H. B. Arrant, Professor at Simmons University, Abilene, Texas, will carry on similar demonstration work in Texas, Louisiana, and Oklahoma.

A Record for Long Service

Captain Harry Wooding, recently reelected mayor of Danville, Va., has served his city in that capacity for 40 consecutive years. At the age of 16 Captain Wooding enlisted with the Danville Grays at the beginning of the civil

Capt. Wooding

war, serving through the four years, the latter part with the celebrated Mosby Guerrillas. He is 88 years old. So far as we know Mayor Wooding enjoys the distinction of having served his city as mayor for a longer continuous period than any other mayor. The last election was a three cornered fight, and Captain Wooding won by an overwhelming majority, clearly indicating the high esteem in which he is held by his fellow citizens who have known and loved him since his boyhood.

Pennsylvania Water Works Operators' Ass'n

The fifth annual conference of the Pennsylvania Water Works Operators' Association was held at State College, Pa., on June 20, 21 and 22 with a total registration just short of 200.

Officers elected for the ensuing year are the following:

President, E. C. Trax, Superintendent of Filtration, Municipal Waterworks, McKeesport, Pa.; first Vice President, M. E. Flentje, Superintendent of Purification, Community Water Service Co., Greensburg, Pa.; second Vice President, H. B. Richards, Superintendent, City of New Castle Water Company, New Castle, Pa.; Secretary-Treasurer, I. M. Glace, District Engineer, Pennsylvania Department of Health, Harrisburg, Pa.

New England Water Works Association

The nominating committee has submitted the following list of nominees for officers for the ensuing year:

For President, Richard H. Ellis, Water Commissioner, Newton, Mass.; for Vice Presidents, E. Sherman Chase, 1300 Statler Building, Boston; Howard M. King, Supt. Springfield Water Dept., 17 Colton St., Springfield, Mass.; for Directors, Roger W. Esty, Supt. Danvers Water Works; Harry U. Fuller, Chief Engineer, Portland Water District; Warren J. Scott, Director Bureau of Sanitary Engineering, Hartford, Conn.; for Treasurer, Albert L. Sawyer, Water Register, Haverhill, Mass.

Michigan Conference on Water Purification

The annual meeting of this conference will be held at Mt. Clemens, Mich., Oct. 5-7, with headquarters at the Medea Hotel. John M. Hepler, State Dept. of Health, Lansing, is secretary.

The largest single order on record for big unit road machinery, consisting of fifty-six (56) 10-ton Autocrat Rollers and sixty-nine (69) # 101 Graders, was recently awarded to The Austin-Western Road Machinery Co. by the Pennsylvania State Highway Department. These machines, built and shipped in record time, will be used to improve a 20,000-mile primary system of township highways that are now under state Control. The illustration shows part of the 70-car shipment on this order.

Developments in Water and Sewerage Equipment

A Portable Pipe Cutting And Threading Tool

The Borden Co., Warren, O., have brought out the Model A Beaver portable pipe machine. This machine will cut, thread and ream ½ to 2-inch pipe —steel, wrought iron, brass or cast iron. Among its marked advantages, considering its unusually low price, are an opening die head, adjustable dies, automatic cut-off, oil pump, positive hand wheel feed, tilting die head and aluminum castings. It is operated by a ½-h.p. motor, reversible at the switch. Complete with stand the weight is less than 400 pounds.

Automatic Proportioning Pump for Feeding Chemicals

A newly designed device has been announced by Proportioneers, Chicago, for controlling injection of accurate percentages of chemicals or reagents in treating operations or for securing accurate samples of liquids. Every proportional processing problem of the Fluid Industries can be simplified or improved by this automatic feeder. The device is called Tret-O-Unit. The operation is controlled by rate of flow of untreated fluid, the mechanism responding to the thru-put of the line to which it is attached. The pump injections are frequent and in direct ratio to the quantity of fluid being treated.

Tret-O-Unit is inexpensive and can be controlled by any existing flow responsive device, such as an ordinary water motor or a rotor or a reciprocating fluid pump. It offers a means of handling the highly specialized problems of:

Water conditioning; acid treatment of gasoline pressure distillate, etc.; chlorinating; proportioning stench liquids to natural gas; sampling of fluids automatically; driving dry feed chemical devices in ratio to flow rate.

Reagent is in contact with *no* part of the device except cylinder and plunger which can be furnished in a wide range of sizes and materials to resist the actions of reagents handled; and for corrosive or abrasive fluids, diaphragm is substituted for plunger.

Literature on Tret-O-Unit, Tret-O-Meter, Tret-O-Rotor or Tret-O-Motor is available by addressing the manufacturer, Proportioneers, 7701 Avalon Ave., Chicago, Ill.

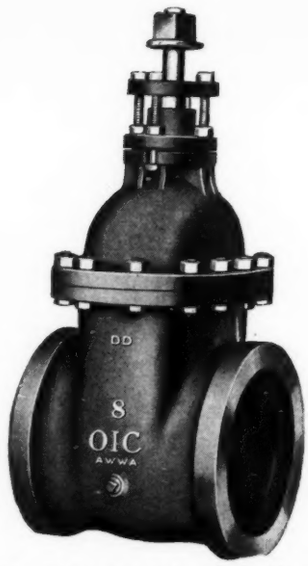
Building Up Large Pipe From Plates

The first installation of Multi-Plate pipe, a super-corrugated metal pipe with a 5-gage invert and 8-gage plates on the remainder of the circumference has recently been made under a railroad near Jackson, Mississippi.

This pipe, developed by the Armco Culvert Manufacturers' Association, was in this case 90 inches in diameter and 125 feet in length. It was installed by the Drainage Engineering Company to replace an arch bridge which had failed. The pipe, which is made in sections, was shipped to the job and assembled in the field. Each section of this 90-inch installation was made up of six plates.

Multi-Plate pipe is similar in appearance to the usual corrugated metal pipe except that it is made of heavy plates strengthened with larger corrugations, and is so designed that it is erected in the field by bolting the plates together instead of being manufactured by the usual shop fabrication methods.

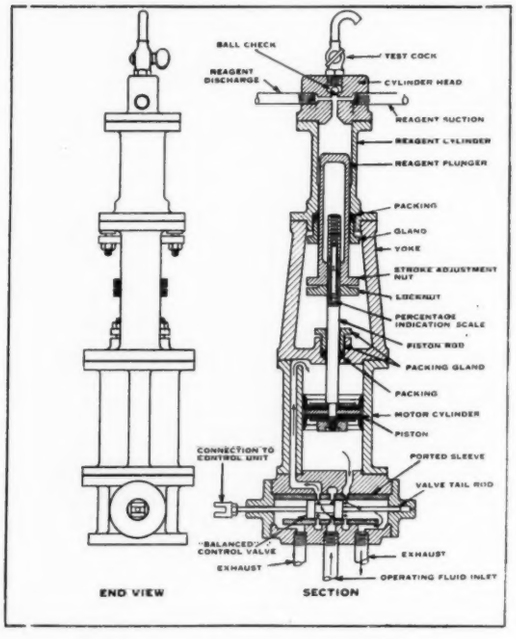
In bolting the plates together the circumferential joints are broken by staggering the plates so that continuous pipe in any multiple of 5 feet can be made without a circumferential seam. All the plates are 10 feet long except the end sections, which are 5 feet long.



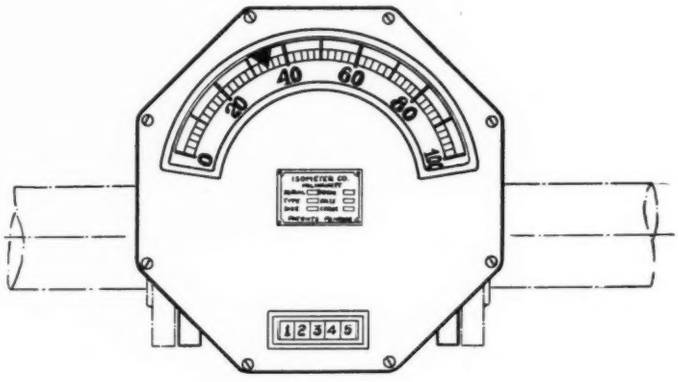
The "O. I. C." hub-end double disk gate valve made by the Ohio Injector Co., Wadsworth, O., are A W W A specifications. A feature is the method of wedge assembly to prevent dropping out or loss of the parts when it is necessary to disassemble the valve.

The Isometer

Manufactured by the Isometer Co., 2357 No. 29th St., Milwaukee, Wisc., the Isometer is an accurate, rugged and reliable liquid flow meter. It uses neither mercury, springs, floats, diaphragms, paddle wheels, gear trains, nor rapidly moving parts. It is built in various styles: 1. Plain indicating; 2. Indicating-Integrating; 3. Indicating-Integrating-Recording, in both line and remote types. It will measure accurately both very low and very high flows. Further information may be obtained from the manufacturers.



End View and Section "Tret-O-Unit"



The Isometer

TO HELP YOU IN YOUR WORK, ANY OF THIS

INDUSTRIAL LITERATURE

WILL BE SENT **FREE** UPON REQUEST

★ *IT is a good practice to check this list regularly because descriptions of new bulletins are always being added.*

Construction Materials and Equipment

Accessories for Motor Trucks

1. Truck accessories—winches, power take-offs, derricks, special bodies, earth boring machines, and trailers of all capacities. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Asphalt Heaters

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

9. Illustrated manual No. 11 describes "Hotstuff," the master oil burning heater. The only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Asphalt Plants

10. Portable Asphalt Paving Plants. These R. R. 1-car plants have easy capacity of 2,250 yards, 2" surface per 8 hours. Cheap to operate. J. D. Farasey Mfg. Company ,Cleveland, Ohio.

Asphalt Rollers

12. How to use Rollers to Save Tamping Costs. 16-page booklet gives details and also specifications of the Erie Roller. Issued by the Erie Machine Shops, Erie, Pa.

Bins and Hoppers

20. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Material Handling Buckets, showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Material Handling Buckets will also be furnished on request.

Clamshell Buckets

27. Clamshell Buckets, showing the various types, sizes and uses for which they are intended, and construction features and other valuable bucket information. A complete catalog on all types of Clamshell Buckets will also be furnished on request. The Owen Bucket Company, Cleveland, Ohio.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully subjects suggested by title.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail Solvay Sales Corp., 61 Broadway, N. Y. C.

35. "A report on Current Practice of using Calcium Chloride for curing Concrete Pavements, Bridges, Culverts and Concrete Products." It includes reports from the Highway Research Board, the Bureau of Public Roads and State Highway Departments. Columbia Products Co., Barberton, Ohio.

Concrete Mixer

44. Concrete Mixers, both Tilting and Non-Tilting types, from 3½s to 84s size. The Jaeger Machine Company, Columbus, Ohio.

Crushers

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Gallon Iron Works & Mfg. Co., E. Jeffry, Mfg. Co., Columbus, Ohio.

Explosives

74. "Use of Explosives for Settling Highway Fills." A new booklet which fully explains by diagrams and charts the three methods developed after many tests by the Du Pont engineers, which singly or in combination will quickly and efficiently do your job. Just issued by E. I. Du Pont de Nemours & Co., Inc., Explosives Dept., Wilmington, Del.

Graders

76. Latest information about Gallon Motor Patrol Graders, Road Maintainers and Leaning Wheel Graders is contained in a new series of illustrated catalogs, Nos. 125, 130, 135 just issued by the Gallon Iron Works & Mfg. Co., c-o The Jeffrey Mfg. Co., Columbus, Ohio.

77. "Blade Graders" is a 48 page booklet, recently published by the Caterpillar Tractor Co., Peoria, Ill., giving the complete details of "Caterpillar" graders.

78. The No. 101 Austin Leaning Wheel Grader is completely detailed and illustrated in Bulletin No. 1238 which shows operation of Z-Bar, back sopper, bank cutter, etc. Published by The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

79. Austin No. 77 Dual Drive Motor Graders are completely illustrated and described in Bulletin No. 1239 which also contains construction details, specifications and weights. Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service. The Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Joint Filler and Line Marker

88. Bulletin No. G-9 issued by Littleford Bros., 452 E. Pearl St. Cincinnati, Ohio, describes and illustrates their new No. 91 Joint Filler which is used to fill horizontal and center joints with hot asphalt. It can be equipped to apply an asphaltic center line as it fills the center joint. This bulletin also describes the Littleford Traffic Line Marker.

Joint Filling Pot

89. A supplement to Bulletin No. E-5 has been issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describing their cone-shaped crack filling pot No. 86-B. The chief feature of this pot is that it is springless—there is no mechanism to get out of order. It is used to fill cracks and joints in concrete pavements and interstices in brick or granite block pavements.

Lanterns and Torches

90. Dietz Lanterns and Road Torches adapted for night traffic warning on any construction work that obstructs the highways. R. E. Dietz Co., 60 Laight St., New York, N. Y.

Loaders and Unloaders

97. Portable Loaders and Unloaders. Folders: Nos. 1073 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076, Portable Bucket Elevators for different classes of work; and No. 1149, the "Grizzly" Crawler Loader for heavy work and large capacities. Link-Belt Company, Philadelphia.

100. Materials Handling and Positive Power Transmission Equipment, giving technical data, list prices and illustrations of this machinery. Link-Belt Co., Chicago, Ill. General Catalog No. 500.

Motor Trucks

105. A new line of heavy duty motor trucks and tractors for dump and commercial hauling is described in literature recently issued by the Sterling Motor Truck Co., Milwaukee, Wis.

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8-32

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106. "Trucks for Public Utilities," is a new illustrated booklet just issued by the International Harvester Co., 606 So. Michigan Ave., Chicago. Covers uses, types, special equipment, bodies and specifications. Sent free on request.

108. Four-wheel-drive trucks increase the range of truck operation and are particularly adapted for economy of operation in road building and maintenance. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Paving Materials

109. A 36-page booklet with 66 illustrations has just been issued by the Barrett Co., giving full information regarding the making, laying and maintaining of "Tarvia-lithic," the ready-to-lay pavement.

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a Tarvia pavement. 24 pages. The Barrett Company, 40 Rector Street, New York.

112. Complete directions for surface Cut Back Asphalt are contained in a 36 treatment and bituminous surfacing with page data book. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

Road Construction

122. "Road Building Machines" is a handy reference booklet to the complete line of "Caterpillar" road machinery. 40 pages.

Road Machinery

125. The following publications cover a wide range of valuable and useful information on road-building machinery. Sixty Leaning Wheel Grader, the Super-Special Grader, the Motor Patrols, the Twenty-Planer, the Hi-Way Patrol Grader No. 3, the Ten Motor Patrol, and the Auto Patrol. Caterpillar Tractor Co., Peoria, Ill.

126. A new picture book of the Austin-Western Line of road machinery showing the application of road graders, road rollers, elevating graders, crawler and wheeled wagons, crushing and screening plants, shovels, cranes and excavators, scarifiers and many small tools, is contained in Catalog No. 1247. Copies available on request at The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

127. "Road Machinery Illustrated." New illustrated bulletins on the motor rollers, three-wheel and tandem rollers, motor graders powered by Caterpillar, Twin City, Cletrac, McCormick-Deering and Fordson tractors, and straight and leaning wheel graders. Galion Iron Works & Mfg. Co., Galion, O.

Elevating Graders

129. An interesting booklet on Elevating Graders has recently been issued by the Caterpillar Tractor Co., Peoria, Ill.

Rollers

131. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Erie Machine Shops, Erie, Pa.

132. A 32-page book in four colors featuring a complete line of road rollers. 8¾ x 11, leatherette cover, numerous action pictures. Buffalo-Springfield Roller Co. of Springfield, Ohio.

133. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers and their uses. The Buffalo-Springfield Roller Company, Springfield, Ohio.

134. "Road Rollers." Illustrated booklets covering the entire line of Master 4-Cylinder motor roller, 4-cylinder tandem roller and International motor roller. Galion Iron Works and Manufacturing Co., Galion, O.

135. 36-page, illustrated book describing the application of Motor Rollers to many types of road construction and maintenance. Huber Mfg. Company, Marion, Ohio.

136. Full description of Huber Motor Rollers in sizes from 5 to 15 tons, included in durable 36-page book for use by road contractors and maintenance crews. Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

Sand and Gravel Buckets

137. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Sand and Gravel Buckets showing the various types, sizes and uses for which they are intended. A complete catalog on all types of Sand and Gravel Buckets will also be furnished on request.

Sand and Gravel Washing Plants

140. Seventy-page catalog giving complete information regarding Sand and Gravel Washing Plants, stationary and portable. Those interested in such equipment should have a copy. Link-Belt Co., Chicago, Ill.

Shovels, Cranes and Excavators

144. Complete information including operating ranges of General Excavators is given in Bulletin No. 3105 recently prepared by The General Excavator Co., 365 Rose St., Marion, Ohio.

145. The Austin Badger, a new, fully convertible ⅜ yard crawler shovel, made by The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago, is fully described and illustrated in their Bulletin No. 1236.

146. Link-Belt Co., Chicago, Ill., has issued Book No. 1095, which describes and illustrates their complete line of Gasoline, Electric, or Diesel operated shovels, cranes and draglines.

Steel Posts

160. Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport Pa.

Surveying Instruments

164. Booklet on the most popular types of Transits and Levels in general use by Engineers and Surveyors, giving full information on the sizes and styles of these instruments. Issued by C. L. Berger and Sons, Inc., 37 Williams St., Boston 19, Mass.

Tires, Truck and Tractor

165. Speed and economy in use of solid, cushion and pneumatic tires and tubes for trucks, cars, tractors, graders and other road machinery. Government Sales Department of the Goodyear Tire & Rubber Company, Inc., Akron, Ohio.

Tool Boxes

167. Bulletin No. G-6 issued by Littleford Bros. 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates the Han-DeeBox, a portable tool box of all-steel construction. This tool box is equipped with a special locking device that locks both covers at the same time. No padlocks are used. Littleford trailers, lead melting furnaces, and "Hot Dope" Kettles for pipe coating are also described in this bulletin.

Tractors, Crawler

171. The design, construction, details and complete specifications of the Ten and Fifteen models "Caterpillar" are given in a booklet published by the Caterpillar Tractor Co., Peoria, Ill.

172. The Caterpillar Sixty Tractor. This beautifully illustrated booklet tells the story of the Caterpillar Sixty Tractor design and construction. Caterpillar Tractor Co., Peoria, Ill.

175. Caterpillar Tractors. The "Fifty;" the "Thirty-five;" the "Twenty-five." Full data on these models. Caterpillar Tractor Co. Peoria, Ill.

Road and Street Maintenance

Asphalt Heaters

200. For general construction and maintenance, the Original Improved "Hotstuf" Asphalt Heater, an economical oil burning heater. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance.

211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barberton, Ohio.

212. "Wyandotte Calcium Chloride Prevents Dust the Natural Way,"—a publication, fully illustrated, treating on Dust Control, economical road maintenance and methods of application, issued by the Michigan Alkali Company, 10 E. 40th St., New York City.

Dust Laying

213. Full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay Calcium Chloride, a Natural Dust Layer," 24 pages, 5½x8, covers application, economies, etc. Sent without cost. Solvay Sales Corporation, New York.

Emulsion Sprayers

214.—A complete line of emulsion sprayers is described in Bulletin No. G-5 recently issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio. Littleford Emulsion Sprayers will spray any type of asphalt emulsion used for penetration patch work or curing concrete. They are also used to spray silicate of soda and weed exterminators.

Highway Maintenance

215. "Road and Street Maintenance Equipment," a compact vest pocket manual containing illustrations and brief descriptions of their extensive line. Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

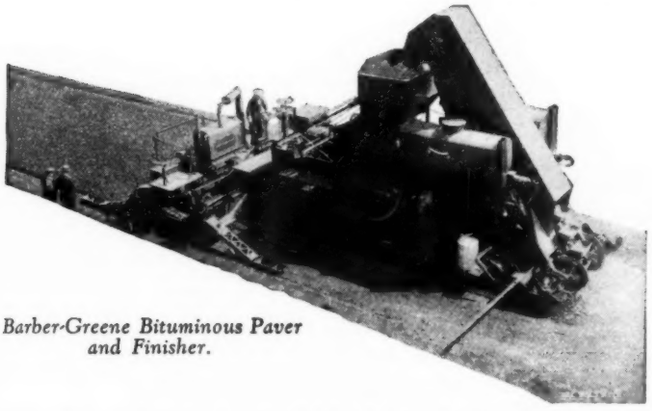
216. "Light and Heavy Road Maintenance" describes fully the FWD truck and its economy for use in pulling road

Maintenance and Construction Equipment

Barber-Greene Three Unit Bituminous Paver and Finisher

The Barber-Greene Bituminous Paver and Finisher is now manufactured as a three unit machine, thus increasing the utility tremendously.

What was previously the paver is now two units consisting of a special loader as the first unit and the mixer as the second unit. The finisher is practically the same as before with the exception of some minor improvements.



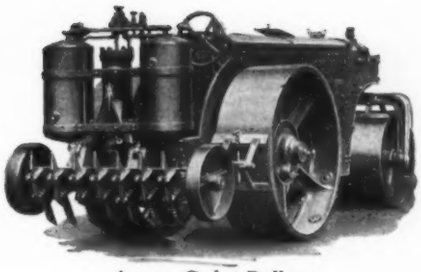
Barber-Greene Bituminous Paver and Finisher.

The loader can grade, do light excavating, load excess dirt that must be hauled away, stock pile and reclaim. It may be run through the windrow for aerifying, drying and replacing in the windrow ready for processing when the loader is returned to the mixer. This method is superior to blading the windrow back and forth because it is thorough, clean and rapid. The loader may be used in the early and late seasons when paving is not possible, for preparation of the subgrade, shoulder work, and the obtaining of sand and gravel aggregates from local sources.

The new design of the loader includes two tanks (400 gallon capacity each) for carrying a supply of oil or asphalt on the loader itself. The addition of these tanks to the loader saves the cost and tying up of an expensive distributor and also the extra labor required. With a windrow of aggregate on the road and oil supply tanks there are no delays and continuous operation is assured. The time and labor efficiency is 100%. The complete housing of the bucket line to reduce dust is an additional improvement.

New Austin Cadet Roller

A new double spur gear drive roller, with a number of very practical operating features, built in 6, 7 and 8-ton sizes, has just been announced by The Austin-Western Road Machinery Co. of Chicago. According to the manufacturers, it has a wide range of usefulness in connection with work on subgrades, stone and gravel courses and on all types of top surfacing such as asphalt, bitulithic macadam, etc., etc.



Austin Cadet Roller

This roller has an extremely low center of gravity, a short wheel base for easy maneuverability and it is balanced scientifically to minimize pitching and side sway. Gears are shifted as easily as on a truck; one clutch lever controls all forward and reverse motion, and the various traveling speeds required for different types of work are fully met by the new Cadet.

The Cadet can be equipped with pneumatic scarifier and a water cooled air compressor that does not stop when motor is idling; the tanks used for storage of air are of extra large capacity. Patented planing blade and sprinkler attachments for rolling hot asphalt are also available.

New Super-Heavy Duty Tractor by White

The White Company, Cleveland, O., has announced a new super-heavy duty tractor known as the Model 691 intended for heavy duty transport hauling.

It has been especially designed to meet the new 40-foot maximum allowance in certain states and makes possible the use in general operation of longer trailers and bodies without increasing the overall combination vehicle length. The whelbase is 129½ inches, and the tonnage rating 7 to 9 tons.

A 15-ton six-wheel-drive FWD, the largest model truck manufactured by the Four Wheel Drive Auto Company, has been ordered by the Iraq Petroleum Company for use in building a pipe line in the Near East, across three nations. This 15-ton FWD, with power on all six wheels, is powered by a 125-horsepower engine through a four-speed transmission with a dual range subtransmission which gives the truck eight speeds ahead and two in reverse. The truck is equipped with a cab and a steel body which measures eighteen feet long and eight feet wide. The over-all length of the truck is 27 feet 2 inches and it weighs 20,945 pounds.

In addition to oiled road construction and maintenance, the Baker Road Disc powered by Caterpillar has many other uses of interest to contractors, road and street officials, such as: Cutting up sod on grassy road shoulders; discing earth fills on grading work; for mixing materials on retread jobs; for making and maintaining sand-clay roads; maintaining cinder streets in cities and villages.

graders and maintainers—issued by Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

218. "Maintenance Machines," a 32 page booklet, tells of "Caterpillar's" complete line of maintenance machines—3 sizes of motor patrols, a trailer patrol and planer—including machines to fit all pocketbooks and all road maintenance conditions. Caterpillar Tractor Co., Peoria, Ill.

Surface Heaters

225. The "Hotstuf" three in one, combination Tool, Asphalt and Surface heater is described and its use illustrated in Bulletin 16. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

Road and Paving Materials

Bituminous Materials

227. "Asphalt for Every Purpose," a 44-page illustrated booklet describing Stanolind Asphalt products. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

228. A new booklet has just been issued by The Barrett Co., 40 Rector St., New York, describing and illustrating the uses of each grade of Tarvia and Tarvialithic. 32 excellent illustrations.

229. A new series of concise and authoritative manuals of construction covering the latest developments in road-mix and surface treatment types as well as the standard asphalt pavements. These contain the best that has been developed by study, research and practical application in all types. Manual 1—Road-Mix Types is now ready for distribution. The Asphalt Institute, 801 Second Ave., New York, N. Y.

Brick, Paving

230. Full information and data regarding the use of vitrified brick as a paving material, cost, method of laying, life, etc. National Paving Brick Manufacturers' Association, National Press Building, Washington, D. C.

Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. 47 pages. The Dow Chemical Company, Midland, Mich.

Gutters

240. "Brick gutters and Parking Strips." A study dealing with the problems faced in the proper construction of gutters and how they can be overcome. Covers design, construction and results. Well illustrated. Just issued by the National Paving Brick Ass'n., National Press Building, Washington, D. C.

Maintenance Materials and Methods

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road with "Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

Snow Removal

348. "Winter Maintenance" is the title of a booklet which illustrates many types of snow plows and methods of handling snow removal problems. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

349. "The Answer to the Snow Removal Problem." It gives full details of the Frink type S snow plow for trucks. Carl Frink, Mfr. of Clayton, N. Y.

354. "Snow Removal Equipment" pictures various types of snow-fighting equipment built for "Caterpillar" Tractors are pictured in relief and in action. Caterpillar Tractor Co., Peoria, Ill.

359. Galion Iron Works and Mfg. Co., Galion, Ohio. Details, prices and catalogs of their snow plows adaptable to any make of truck.

Sanitary Engineering

Glass-Overs

393. Full details regarding the use of Lord & Burnham Glass-Covers at Dayton, Ohio; Highland Park, Ill.; Fostoria, Ohio; and Bloomington, Ill. are given in bulletins Nos. 10, 11, 14, 15. Issued by Lord & Burnham, Graybar Bldg., New York, N. Y.

Jointing Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections. Atlas Mineral Products Company, Mertztown, Pennsylvania.

402. Full details concerning No. 1 Korite for sealing sewer pipe joints so that they will be permanently tight. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

403. An illustrated folder has just been issued by the Cochrane Chemical Co., 432 Danforth St., Jersey City, N. J., detailing the advantages and the savings in the use of Ex-XL-cell Sewer Pipe Joint Compound.

Manhole Covers and Inlets

404. Street, sewer and water castings made of wear-resisting chilled iron in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., South Bend, Ind.

Pipe, Cast Iron

407. New "Handbook of deLavaud Centrifugally Cast Iron Pipe" contains useful information for the water works man including revised specifications together with dimensions and weights of deLavaud pipe in accordance with Federal Specifications for Pipe; Water, Cast-Iron (Bell and Spigot) N. WW-P-421. Just issued by the U. S. Pipe and Foundry Co., Burlington, N. J.

Pipe Line Construction

410. Pipe Lines and the Caterpillar. In this 32-page booklet are pictured many uses of the Caterpillar Tractor, and ways in which they can be applied to the saving of men, money and minutes. The Caterpillar Tractor Co., Peoria, Ill.

Pumping Engines

413. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Pumps, Centrifugal

415. Design data for centrifugal pumps for high or low service pumping for water-works and filtration plants. Dayton-Dowd Co. Mfrs. Centrifugal Pumps, Quincy, Ill.

Pumps, Self-Priming

416. "Make your present pumps self-priming." Bulletin No. 530 B describing the Hazleton Suction Line Primer which can be applied to old as well as new pumps regardless of make. Issued by Barrett, Haentjens & Co., Hazleton, Pa.

Pumps—Sewage

417. Non-clog vertical and horizontal sewage pumps and their characteristics are described and illustrated in bulletins of the Dayton-Dowd Co., Quincy, Ill.

Screens, Sewage

418. Sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit), and Mechanical Aerators for activated sludge plants. Link Belt Company, 910 So. Michigan Ave., Chicago, Ill. Book 642.

Screens

420. Water Screen Book No. 1252, describes water screens and gives complete technical information about them. Link-Belt Co., Chicago, Ill.

Sludge Bed Glass Covers

426. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

427. Bulletin GE31 describes Glass Enclosures for Sludge Beds in detail. Specifications, cross sections, details and illustrations shown are of value to engineers and officials. Sent promptly upon request. American-Moninger Greenhouse Mfg. Corp., Dept. B, 1947 Flushing Ave., Brooklyn, N. Y.

Treatment

433. Collectors and concentrators for modern sewage treatment plants, recent installations, and full data on aerators, and screens. Link Belt Co., 910 So. Michigan Ave., Chicago, Ill. and Philadelphia.

Water Development

440. Complete details of the Layne System of water development for municipalities and irrigation projects, based on deep wells and turbine pumps. Layne & Bowler, Memphis, Tenn.

Official Advertising

STATE DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
ALBANY, N. Y.

Sealed proposals will be received by the undersigned at the State Office Building, 13th Floor, Albany, N. Y., until one o'clock p. m. advanced standard time, which is twelve o'clock noon eastern standard time, on Tuesday, August 9, 1932, for the reconstruction of highways in the following Counties:

CLINTON	$ 5,000.00
(Concrete: 2.25 miles)	
LIVINGSTON	8,000.00
(Concrete & Bit. Mac. M. M. Optional: 3.68 miles)	
MONTGOMERY	1,700.00
(Bridge: 60' Girder Concrete Appr.: 0.05 miles)	
ONONDAGA	1,400.00
Bridge: 40' I-Beam Bit. Mac. Optional Appr.: 0.16 miles)	
ST. LAWRENCE	1,900.00
(Bridge: 100' Truss Concrete Appr.: 0.20 miles)	
SARATOGA	1,300.00
(Bit. Mac. Mixing Method, Type 3: 0.92 miles)	
WARREN & SARATOGA	14,000.00
(Bit. Mac. Pen. Method: 2.61 miles)	
WAYNE	8,000.00
(Concrete: 3.78 miles)	

Sealed proposals will also be received for the heating and sanitary work in the Storehouse at Watertown, Jefferson County, in accordance with the provisions of Chapter 25 Laws of 1932.

Maps, plans, specifications, and estimates may be seen and proposal forms obtained at the office of the Department in Albany, N. Y., and also at the office of the District Engineers in whose district the roads are located, upon the payment of Five Dollars ($5.00) for plans and

Killefer Road Disk

Killefer Road Disk

This machine, produced by the Killefer Mfg. Corp., 5525 Downey Rd., Los Angeles, Calif., is not, strictly speaking, new, but it has been used very little in the east. It has been found to have many advantages in low cost road construction and maintenance. The disks are set at a slight angle to the center line of the road, and can be raised or lowered, to make shallow or deep cuts. The use of this equipment will be discussed in the series of low cost road articles beginning in this issue of PUBLIC WORKS, and additional information can be secured from the manufacturers. Unless road conditions are unusually bad, one trip smooths the surface, satisfactorily removing corduroy, waves, and humps.

Carry-All Reversible Trailer

The La Crosse Tu-Way, a distinctly new type of heavy-duty carry-all trailer, has been announced by the C. R. Jahn Company, 1140 First National Bank Building, Chicago, Illinois. It is manufactured at La Crosse, Wisconsin.

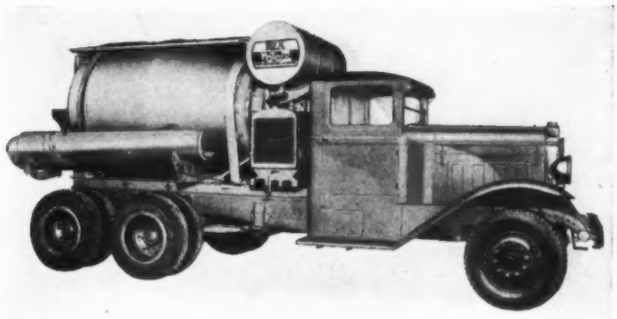
As its name suggests, the trailer is fully reversible, and may be pulled, steered and braked from either end. It is built in capacities of from 10 to 40 tons, and may be used to haul practically any heavy, cumbersome object or material, such as road building machinery, heavy contractors' equipment, structural steel sections, tractors, vaults, etc.

The Tu-Way differs from the conventional type of heavy machinery trailer in that it eliminates the necessity of a high front deck. Its low flat platform may be loaded from either end or side. It provides the shortest possible wheel base and all-over length without sacrificing loading space. It will make right-angle turns following exactly the track of the truck pulling it.

Weight Proportioning of Concrete

The feasibility and efficiency of proportioning concrete by weight has been strikingly proved by the record of the Toledo Aggregate Determination Auto-Gage used in the construction of the Koon Dam in Pennsylvania, 720 feet long and 90 feet high. When the job, involving approximately 81,000 barrels of concrete, was completed, the difference between records of materials received and cement used was only 4/10th of 1%, including the usual waste in transportation. The electric recording device on the scale gave a complete record (never before obtained on a concrete job) of each batch for future study by engineers. Although the equipment was in operation 24 hours a day, while concrete was being poured, and weighed 360,000,000 lbs. of concrete, the pivots and other parts of the scale, when inspected at the completion of the job, showed no appreciable signs of wear.

The new Reo 6-cylinder Speed Wagon is a strongly built 1½-ton truck.



Rex 5-yard Moto-Mixer

New 5-Yard Rex Moto-Mixer

The Rex Moto-Mixer as a truck mixer handles 5 cubic yards of mixed concrete and as an agitator, 7 cubic yards. The Chain Belt Company, Milwaukee, has introduced this model for the big ready-mix plant, especially the plant operating on big contracts. The 7-yard agitator is the largest pay load that can be put on wheels.

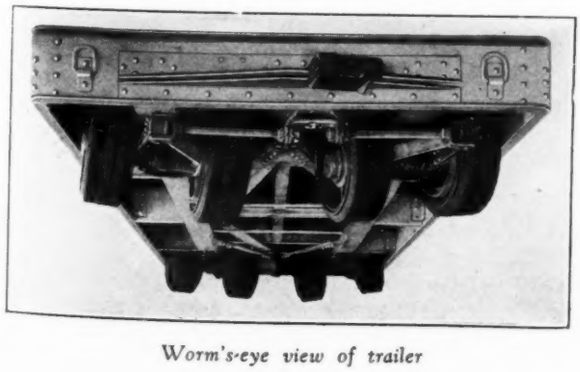
Jaeger Road Builder Truck Mixer

To meet the great increase in highway widening and curb and gutter work, the Jaeger Machine Company, Columbus, Ohio, has developed a truck mixer unit specially adapted to such work, as well as sewers, sidewalks, culvert and general commercial concrete delivery. In addition, the side discharge feature of this unit makes possible the new Jaeger method of building roads and streets.

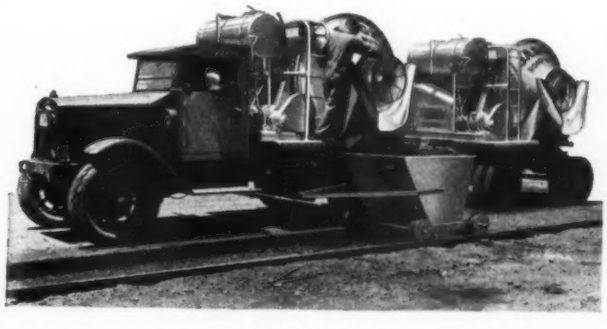
For road widening work the small, inexpensive distributing box is fastened to a quickly removable pipe on the truck chassis. This box, drawn along with the mixer, spreads the concrete as rapidly as the batch is discharged, greatly increasing the speed of the widening operation and reducing spreading costs.

Combined use of truck mixer and mixer mounted on trailer, for which the side discharge is ideally adapted, also offers means of reducing the ton mile cost with a minimum of investment.

Jaeger road builder truck mixers with dual side discharge are built in 2½ and 5 yd. capacities. A descriptive bulletin on these units has recently been published by the Jaeger Company and is available on request.



Worm's-eye view of trailer



Jaeger Road builder truck mixer

proposal forms. Standard specifications are Two Dollars ($2.00) per copy. Refund will not be made on plans, proposal forms or specifications. The addresses of the District Engineers and the counties in each district will be furnished upon request.

Plans and proposal forms may also be seen at the office of the State Department of Public Works, State Office Bldg., Worth and Center Streets, New York City.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications, and contract agreement.

A. W. BRANDT,
Commissioner of Highways.

STATE DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
ALBANY, N. Y.

Sealed proposals will be received by the undersigned at the State Office Building, 13th Floor, Albany, N. Y., until one o'clock p. m., advanced standard time, which is twelve o'clock noon eastern standard time, on Tuesday, August 16, 1932, for the construction of highways in the following Counties:

GENESEE $21,000.00
(Concrete: 6.30 miles)
LIVINGSTON & WYOMING..... 11,000.00
(Concrete: 4.44 miles)
ONEIDA 10,000.00
(Concrete: 5.00 miles)

Also for the reconstruction of the following:

ALLEGANY 15,000.00
(Concrete 6.77 miles)
CATTARAUGUS 6,000.00
(Bit. Mac. Pen. M.M. Type 3:2.33 miles)
GENESEE 9,000.00
(Concrete: 3.87 miles)
JEFFERSON 2,500.00
(Concrete: 1.45 miles)
ORANGE & SULLIVAN (Cons. & Recons.) 22,000.00
(Concrete: 3.46 miles)
ST. LAWRENCE 18,000.00
(Concrete: 8.76 miles)
SCHENECTADY & SCHOHARIE
(Cons. & Recons.)..... 9,000.00
(Prelim. Grav. & Surf. 8.67 miles)

Sealed proposals will also be received by the undersigned at the State Office Building, 13th Floor, Albany, N. Y., until one o'clock p.m., advanced standard time, which is twelve o'clock noon eastern standard time, on Friday, August 19, 1932, for the construction of highways in the following County:

YATES $12,000.00
(Prel. Grav. Surf. 5.64 miles)

Also for the reconstruction of the following:

CHEMUNG 3,100.00
(Concrete: 1.07 miles)
FRANKLIN 2,100.00
(Bit. Mac. M.M. Opt.: 0.47 miles)
MONROE 21,000.00
(Concrete: 8.25 miles)
ONEIDA 17,500.00
(Concrete: 8.23 miles)
ONTARIO 36,000.00
(Concrete: 9.90 miles)
ORANGE 27,000.00
(Concrete: 9.12 miles)
OSWEGO 4,000.00
(Concrete: 1.98 miles)
RENSSELAER 3,600.00
(Concrete: 1.96 miles)
SCHOHARIE 12,000.00
(Concrete: 3.75 miles)

Maps, plans, specifications, and estimates may be seen and proposal forms obtained at the office of the Department in Albany, N. Y., and also at the office of the District Engineers in whose district the roads are located, upon the payment of Five Dollars ($5.00) for plans and proposal forms. Standard specifications are Two Dollars ($2.00) per copy. Refund will not be made on plans, proposal forms or specifications. The addresses of the District Engineers and the counties in each district will be furnished upon request.

Plans and proposal forms may also be seen at the office of the State Department of Public Works, State Office Bldg., Worth and Center Streets, New York City.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications, and contract agreement. All contracts advertised above are emergency contracts. The minimum rate for labor on these contracts shall be from forty to fifty cents per hour as specified in each contract. Veterans of the United States Military Service with dependents who are qualified to do the work shall be given preference in employment. Where feasible and practical, hand labor will be required. No person, except those in supervisory or executive positions, shall be employed for more than thirty hours in any week. Details of these regulations will be found in the itemized proposal.

A. W. BRANDT
Commissioner of Highways

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ALBANY, N. Y.

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NASSAU $24,000.00
(Concrete: 3.81 miles)
QUEENS 79,000.00
(Concrete: 7.35 miles)

Maps, plans, specifications, and estimates may be seen and proposal forms obtained at the office of the Department in Albany, N. Y., and also at the office of J. J. Darcy, District Engineer, 122 West Main Street, Babylon, N. Y., in whose district the roads are located, upon the payment of Five Dollars ($5.00) for plans and proposal forms. Standard specifications are Two Dollars ($2.00) per copy. Refund will not be made on plans, proposal forms or specifications.

Plans and proposal forms may also be seen at the office of the State Department of Public Works, State Office Bldg., Worth and Center Streets, New York City.

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A. W. BRANDT,
Commissioner of Highways

Index to Advertisements

When you want catalogs describing materials or equipment advertised in PUBLIC WORKS, refer to the classified INDUSTRIAL LITERATURE section beginning on page 45 and order by number.

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